THE
TROPICAL AGRICULTURIST:
JOURNAL OF THE
CEYLON AGRICULTURAL SOCIETY.

VOL. L. PERADENIYA, JUNE, 1918. **No. 6.**

EXPERIMENTS WITH COCONUTS.

In the April number of the TROPICAL AGRICULTURIST were given the results of coconut experiments in Ceylon up to the end of the year 1917.

The first figures relate to the experiments at the Chilaw Trial Ground, and from the tabulated results as well as from the graphs based upon these results, it can be seen that improvements in yields have been continuous since 1915, over half the Trial Ground. The most satisfactory yields have been given by the plot that has received no manure since 1915 but has been cultivated monthly with disc harrows during the years 1916 and 1917. The results from the plot that has been kept clean weeded have also been generally satisfactory throughout, while the plots that have received applications of lime and of mineral manures have shown good improvement.

At Pitiakande, continuous increases in crops from 1914 to 1917 have been obtained from the plot that has been cultivated monthly with disc harrows and from that plot in which cattle were tied to the trees. The plot which was ploughed with the village plough twice yearly has also given satisfactory crops in those years which were climatically favourable for coconuts.

At Negombo, the experiments are carried out with young coconuts. Most careful measurements of leaves and heights of

palms have been systematically recorded by MUDALIYAR RAJAPAKSE and from the tabulated results it is seen that the most satisfactory growth is shown on that plot which has been ploughed every month, while those plots which have received applications of mixed manures have made good progress.

From a consideration of the whole of these results it may be generally concluded that ploughing coconuts is to be recommended and that the monthly stirring of the soil with disc harrows is likely to result in increased crops if the general texture and body of the soil is satisfactory. Although in these experiments the disc-harrowing has been carried out monthly, it is anticipated that such could not be performed upon all estates in the colony. Disc harrowing should be carried out as frequently as possible and the actual periods between successive cultivations must be left to the Superintendent. In some districts and upon some soils, these cultivations will require to be more frequent than in other districts and upon other soils. In wet weather they will probably require to be less frequent than in dry. The judgment of the individual has to be depended upon in the practice of agriculture and this judgment is moulded by the school of experience.

It is yet early to draw any conclusions from the effects of manures. On the relatively heavy soil of the plots at Chilaw, applications of lime have proved satisfactory; at Pitiakande organic manure in the form of cattle dung has shown its good effect, while at Negombo the best results for young palms are to be seen in those plots which received general mixtures. Conclusions cannot be drawn from experiments with permanent tropical products until several years' results are available and then it is difficult to formulate a definite opinion if control plots have not been numerous and the natural yields of the plots ascertained.

On one point, however, some evidence is being secured. Coconuts which have been manured from date of planting appear to come into bearing at an earlier date than those which have received no manure. Whether the time so gained repays the cost of the manures has still to be ascertained. Many experienced planters are fully convinced that it does.

RUBBER.

MANURIAL EXPERIMENTS WITH YOUNG RUBBER AT PERADENIYA.

Manuring experiments with rubber planted in double rows 15 ft. apart by 40 ft. apart: average 50 trees per row, were begun in 1916 at Peradeniya Experiment Station. The first three double-rows after the control were limed at the rate of 8 cwts. per acre and then manured

The end double row near the road was kept as control.

The other three double-rows it was decided to manure without liming.

1. } Lime at 560 lb. per acre and { Manure mixture Phosphoric acid and Potash *without* Nitrogen.
2. } { ,, ,, Nitrogen and Potash *without* Phosphoric acid.
3. } { ,, ,, Nitrogen and Phosphoric acid *without* Potash.
4. No manure but treated with 560 lb. lime.
5. Manure mixture as No. 1
6. ,, ,, ,, 2 } No lime
7. ,, ,, ,, 3

First manured in March 1916.
Second ,, June 1917.
Third ,, April 1918.

NEW PLOT MANURES.

Nos. 1 & 5 without Nitrogen. 50 lb. of each constituent per acre.

Plot.					
34·5	lb. Ord. Superphosphate	18%	138 lb.	25 lb.	} 50 lb. P_2O_5
36·5	,, Basic Slag	17%	147 ,,	25 ,,	
30·0	,, Sulphate Potash	40%	120 ,,	50 ,,	50 lb. K_2O
101·0	lb.		405 ,, per acre.		
			101 ,, per plot.		

Nos. 2 & 6 without Phosphoric Acid.

Plot.				
69 lb.	Nitrolim	18%	277 lb.	50 lb. N
30 ,,	Sulphate Potash	40%	120 ,,	50 ,, K_2O
99 ,,			397 ,, per acre.	
			99 ,, per plot.	

Nos. 3 & 7 without Potash.

Plot.					
69·0	Nitrolim	18%	277 lb.	50 lb.	N.
34·5	Ord. Superphosphate	18%	138 ,,	25 ,,	Phos. acid.
36·5	Basic Slag	17%	147 ,,	25 ,,	,, ,,
140·0			562 ,, per acre.		
			140·0 lb. per plot.		

CULTURAL TREATMENT.

Planted 15 ft. by 15 ft. and 40 ft. between double lines, in June 1913.
June 1913.—One acre planted with Groundnuts.
January 1914.—Groundnuts were harvested and mulched.
June 1913.—Other acre was sown with green gram.

November 1913.—Green gram seed was collected, leaves and stalks were ploughed in and resown with green gram after disc harrowing.

February 1914.—Green gram was harvested and ploughed.

February to May.—The land kept disc harrowed.

June 1914.—Crotalaria striata sown broadcast and disc harrowed.

August 1914.—Crotalaria germinated poorly and the plants were pulled up and the rubber trees mulched with other jungle stuff.

November 1914.—Crotalaria was resown in drills 2 ft. apart after using the disc harrow.

February 1915.—Crotalaria was pulled up and mulched after lightly forking round the rubber trees.

February to May.—The land kept disc harrowing.

May 15th.—Crotalaria sown broadcast.

August 1915.—Crotalaria striata was uprooted and mulched the trees. The land was disc harrowed.

November 1915.—Cow peas were sown thickly.

January 1916.—Trees were forked round and mulched with cow peas. The land ploughed and kept disc harrowing till March.

7th March 1916.—Lime applied for the control and the three other plots after the control, at the rate of 8 lb. per tree.

March 1916.—Manures were applied between the avenues in trenches 2 ft. by 6 in.

June 1916.—Leucæna glauca was sown in the 40 ft. space after leaving a space of 5 ft. from the trees.

February 1917.—Leucæna was pruned and mulched along the rows of trees.

September 1917.—Leucæna was pruned and mulched the trees.

March 1918.—Leucæna was pruned and mulched the trees.

20th April 1918.—Leucæna glauca in the first 4 plots were removed with the roots.

GIRTH AND HEIGHT MEASUREMENTS.

Plot	Treatment.	Girths at 3 feet.				Height in feet.			
		July 1916	Jany. 1917	July 1917	Jany. 1918	July 1916	Jany. 1917	July 1917	Jany. 1918
1	Lime	6·00	7·62	9·16	11·32	16·9	19·5	23·0	26·0
	Increase	—	1·62	1·54	2·16	—	2·6	3·5	3 0
		—	—	—	5·32	—	—	—	9·1
2	Lime & mix. without Nitrogen	7·25	8·68	10·43	12·54	19·3	21·2	23·8	26·5
	Increase	—	1·43	1·73	2·11	—	1·9	2·6	2·7
		—	—	—	5·27	—	—	—	7·2
3	Lime & mix. without Phosphoric acid ...	6·85	8·51	10·46	12·68	17·7	19·8	22·6	25·3
	Increase	—	1·66	1·95	2·22	—	2·1	2,8	2·7
		—	—	—	5·83	—	—	—	7·6
4	Lime & mix. without Potash	7·04	8·97	10·48	12·65	18·0	19·7	23·6	26·3
	Increase	—	1·93	1·51	2·17	—	1·7	3·9	2·7
		—	—	—	5·61	—	—	—	8·3
5	Mixture without Nitrogen ...	7·40	9·34	11·23	13·21	18·4	20·9	23·4	25·8
	Increase	—	1·94	1·89	1·98	—	2·5	2·5	2·4
		—	—	—	5·81	—	—	—	7·4
6	Mixture without Phosphoric acid	8·00	9·18	11·22	13·86	19·90	21·7	24·7	27·1
	Increase	—	1·18	2·04	2·64	—	1·8	3·0	2·4
		—	—	—	5·86	—	—	—	7·2
7	Mixture without Potash ...	8·30	10·22	12·24	14·80	20·6	23·8	27·2	31·0
	Increase	—	1·92	2·02	2.56	—	3·2	3·4	3·8
		—	—	—	6·50	—	—	—	10·4

COCONUTS.

MANURING COCONUTS.

On pages 201 to 203 of the TROPICAL AGRICULTURIST for October, 1917, will be found details of manuring coconuts on an estate in Ceylon. Similar figures for the year 1917 are now given:—

It is very interesting to note the rise and fall of the crops according to the rise and fall of rainfall. The increase of nuts in the years 1916 and 1917 to about 80 and above is very strange considering the fact that my fifth application, applied in 1915 and 1916, was comparatively a poor mixture devoid of all potash. Last year's rainfall was 56·65 inches, and this year's crops up to date are less.

A large increase of nuts in Plot 4A. took place in 1916. At the fourth application the whole of this Plot (A. & B). was not manured. This has had some effect is apparent from the crops of Plot B. for 1916. But, along with the fifth application Plot A. was manured in November 1915. The mixture contained 4 lb. slaked lime. In all other plots slaked lime was broadcasted. The increase in Plot 4A. over the previous highest year (1913) is about 10½ nuts, while in all the other plots the same being between 2 to 5. In 1917, the crop of this plot only dropped, while in others it rose. Whether the mixing of lime with the manure has the effect of giving increased crops sooner than otherwise, might be worthy of investigation.

Disc-harrowed Plots 4 B, 7 & 8 :—4 B. has not been manured since the third application, and the other two since the fourth. Their results appear to be quite satisfactory, especially 4 B. which can be reckoned as the actual control plot, the other two plots being rather young.

There is one serious drawback to the continuance of disc-harrowing. The land in these plots is somewhat sloping. During the rainy season in some places the whole layer of the surface soil is washed off. To prevent this, trenches were cut and the earth mound heaped on the upper side. But the rain falls so heavily within a short time even the trenching cannot prevent the wash off.

CROP FIGURES FOR 1917.

Block No.	Acreage.	Nuts per Candy. 1917	Average nuts per tree.	Lot No.	1917
1	33¾	1,093	— ...	1	73·26
2	34¾	1,122	Age of trees in ...	2	83·33
3	32	1,100	Plots 1 to 6 ...	3	86·81
4A	31½	1,119	— ...	4 A	90·26
B	10	1,073	About 35 years ..	4 B	91·64
5	18¼	1,085	— ...	5	86·69
6	16½	1,082	— ...	6	90·26
7	24½	1,090	Average of Plots 1 to 6 ...		86·03
8	16¾	1,087	Age in 7 and 8 between ...	7	75·18
			20 to 26 years ...	8	87·29
Total	218	1,145	Average of Plots	1 to 8	83·70

Rainfall 56·65.

N.B.—Nuts per Candy in each plot is obtained by weighing one hundredweight of copra dried separately in each plot. But the total is not the average of the figures for all the eight plots. It is obtained by dividing the actual number of nuts dried during the year by the total number of candies cured from same.

Average per tree is also worked in the same manner.

Communicated

RICE.

TRANSPLANTING IN THE CONTROL OF "WILD" RICE IN ITALY.

B. MARCARELLI.

In the Italian rice-fields the name "riso-crodo" or "riso selvatico" (wild rice) is given to plants forming sub-varieties, now become wild, of the oldest variety of rice cultivated. They are characterised by :—vigorous growth from the beginning : the ease with which the grain drops from the panicles with the slightest contact ; the vitality of the grain lasting many years. They are placed in two principal categories :—(1) with white panicles ; (2) with red panicles. The first category, which is the more common and more dangerous because of the ease with which the grain falls when ripe, includes plants of medium growth, with white nodes, rather compact large panicles with round, bearded grain of a silvery white after earing and during flowering, but yellowish when ripe. The plants of the second category are less dangerous, because less common with little tendency to remain wild ; they are straight, high, with black nodes, slightly hulled or bare grain, long and covered with a yellowish-red down. During the past few years there has spread more extensively another sub-variety, with long-bearded, black panicles, whose grain falls very easily and spreads quickly.

It is impossible to exterminate these plants by uprooting ("rimonde"), because, while green, they resemble cultivated rice very closely, and, after earing, they are very similar to "Ostiglia" and "Lencino" rice. It is for this reason that they are the cause of serious loss in permanent rice fields, a loss exceeding that caused by the most common weeds, sometimes affecting 70 to 80 per cent. of the yield. Moreover, the few grains which pass into the crop decrease its value. . . . . .

When a rice field infested with "wild" rice has been under rotation for one or two years with meadow grass or wheat, and the turn of rice comes round again, the "wild" rice appears again, stronger than ever, because a large number of grains remain alive in the soil. The methods recommended for the control of "wild" rice are.—Turning poultry on to the rice field immediately after the harvest; burning the stubble whenever and wherever possible ; deep winter and spring ploughing ; careful and continuous weeding of the field ; collecting the panicles immediately after flowering ; sowing in lines so that all plants growing in the spaces may be pulled up.

Nevertheless, all these methods are not always efficient for fighting or preventing the spread of the plants ; but they disappear easily and quickly if the transplantation method is adopted. By this method, between two harvests of rice, may be obtained one of colza, crimson clover, hay or rye. The "wild" rice seeds which have shot up during this intermediate harvest ripen with great difficulty on account of the insufficient winter spring temperature. The basis of this method is as follows : as soon as transplantation has been carried out, the level of the water must be raised from 5 to 30 cm., thus the "wild" rice remains too long out of contact with the air and rots. The few plants which survive are soon outstripped and overcome by the cultivated rice, and rapidly turn yellow and die.

The life cycle of "wild" rice is much affected, and completely stopped after two or three years of the transplantation method, which is the only efficacious one for eradicating this weed from new rice fields, or old or mountain ones.—BULL. INTERNAT. INST OF AGRIC. FEBY. 1918.

TOBACCO.

A STUDY OF TOBACCO WORMS* AND METHODS OF CONTROL.

BY LEON B. EDROZO.

Thesis presented for graduation at the College of Agriculture, Philippines.

INTRODUCTION.

The extent of the tobacco industry in the Philippines and the wide distribution of the product in the world's markets make tobacco one of the very important money crops of the country. Because of this importance, investigation of questions bearing directly upon the growing of the tobacco plant and the production of leaves desirable for manufacture is necessary from a practical point of view. In most countries, where tobacco is grown on a large scale, a thorough knowledge of the plant and its enemies is considered essential for the production of leaves of high quality, the only kind that makes the industry yield its paramount profit.

Tobacco growers the world over are familiar with a number of tobacco worms which by the damage they do to the leaf tend to reduce the profits of the crop. The loss from this cause, which varies greatly from year to year, is due largely to attacks of such insects while the plants are still in their most active period of growth. Throughout the tobacco regions in the Philippines, little attention has been given to the study of tobacco-worms, though it is considered one of the controlling factors in tobacco raising. The estimated loss from this pest in the islands runs into hundreds of thousands of pesos annually. In the Cagayan Valley during the tobacco season of 1915-1916, the loss amounted to from 40 to 60 per cent. of the possible crop. Much of this loss might be prevented if the producer had been in a position to give the matter some study and use intelligent precautions for control.

The present paper is intended to outline for the practical producer the life histories of the various tobacco-worms and their behaviour, and to explain the known measures by which such enemies can be prevented or eradicated. In the present paper four species found on the farm of the College of Agriculture have been used, namely *Prodenia litura*† *Fabr.*,

* A common name given to the larvæ or caterpillars of several species of lepidopterous insects injurious to tobacco leaf during the growing period.

† Hampson Cat. Lep. Phal. B. M. (1909) 8:245.

NOTE:—The species treated in this thesis is undoubtedly *P. litura* F. described for many years as *P. littoralis* and incorrectly identified in America as *P. ornithogalli* Guen., a species confined to the western hemisphere and which, while closely allied, has nothing to do with the old word *litura* spreading eastward from Egypt to the Philippines and southward to Australia, through Borneo, New Guinea and most of the Islands of the Indo-Australian region. (C. S. Banks).

Chloridea assulta Guen., *Plusia eriosoma* Guen., and *Gnorimoschema heliopa* Trower; and all have been carefully studied in the insectary, as well as in the field.

THE TOBACCO CUT-WORM, *Prodenia Litura* FABR.

Prodenia litura Fabr. is a moth belonging to the family Noctuidæ. The adult is characterized by having semi-erect tufts of scales on the metanotum. The fore legs are smoothly scaled. The head is yellowish brown, fore wings with some ochreous strokes at the base and suffused with pale brown; about one-third the distance from the base of the anal margin are two heavy white patches, sloping obliquely backward but not reaching the costal margin; these are cut transversely by two white patches running from the basal portion down to about the middle of the wing; there is still another white patch from the base almost parallel with the costal margin of the wing; black streaks occupy the greater part of the wing, especially near the tip; ciliæ black with pale streaks through them. The hind wing is opalescent white with a dark marginal line, which is most distinct at the tip; the veins are pale brownish yellow, darker and heavier at tip. Abdomen is darker brown above than below; spiracles black, five in number on each side; the proboscis and antennæ are long and dark brown.

DISTRIBUTION.

According to Swinhoe* *Prodenia litura* Fabr., called *Prodenia littoralis* by BOISDUVAL, occurs throughout the Oriental as well as southern Pallarctic region and in the Philippines. HAMPSON gives the Mediterranean sub-region and the eastern tropics as its range. In India *Prodenia litura* is recorded from the Himalayas and Tigris and has been reared by all entomologists connected with the Department of Agriculture.

EXTENT OF INJURY.

In the school year 1913 and 1914, larvæ of this moth appeared on tobacco plants but rarely at the College of Agriculture. They were noted feeding on tobacco and cabbage. In 1914 and 1915, during the period of greatest growth of the crop, they were noted in large numbers in the tobacco plantation of one of the students, where they were observed to be very destructive. The fields used had been previously planted with cabbages that were infected with great numbers of larvæ. During that year (1914-1915), besides being on tobacco and cabbage, they were noted feeding on castor oil plants, peanuts, lettuce, and celery. As the larvæ pupate in the ground, it is reasonable to suppose that such places are thoroughly infested with the pest and that later crop plants then will be liable to attacks in force. For this reason, fields planted with crops infested with larvæ should not be planted with tobacco the following year.

The caterpillar, when young, eats the soft epidermal tissues of the leaf but when full grown it becomes voracious, eating the whole tissue of the leaf. Leaves newly poled are also attacked and great destruction may occur in the curing shed. The caterpillar begins eating along the midribs and then proceeds gradually toward the margins until none of the blade of the leaf remains. Knowing this behaviour of the insect, every *veguero*†

* Catalogue of Eastern Lepidoptera Heterocera (1900) 2: 32 Fauna of British India, Moths (1894) 2, 247.

† Spanish term in common use to designate one who harvests and poles tobacco leaf.

should instruct labourers to look sharply for worms on both surfaces of the leaves at the time that poling is done. Eggs must also be looked for, otherwise they will soon hatch, and trouble will result.

The life cycle of this moth requires about a month for completion.

LIFE HISTORY.

Eggs.—The female lays eggs in masses on both surfaces of the leaves. Each egg is covered with a brown or buff coloured mass of hair-like scales from the anal tuff of the moth. Eggs are arranged in close rows. They are pale green, almost spherical, being flattened beneath and seen from above are radially ridged. Viewed from the side, ridges can be noted, the depressions between which are very shallow. Transverse stripes are also noted with narrower spaces between. The diameter of the egg is ·5 mm. Counts of eggs show from 104 to 103, the majority of hatches contained 200 to 300. A single moth has been found to lay 433 eggs.

Eggs laid 1st night	...	...	...	261
Eggs laid 2nd night	...	...	...	172
				433

Number of mature eggs found in one female when dissected, 274.

On the third day after laying the eggs hatch.

First instar.—The newly hatched larvæ is about 1·5 mm. long. It has four pairs of abdominal legs situated on the third to the sixth segments respectively. It has a semi-looper's gait when walking. Larvæ after hatching remain in company at the place where they hatch and feed on the soft tissue of the leaf. As they eat they spread apart a little and after a few days, scatter over the leaf surface. The most striking feature of the young larvæ is the dark band crossing the first abdominal segment; this characteristic is of great value in identifying the caterpillars of *Prodenia litura*.

Second instar.—After four days the first molt takes place. The length increases to 3·5 mm. Head, amber yellow, with black scattered spots. Thorax, dull yellowish green. At this time there appears an indistinct central longitudinal line of orange or yellow extending from the head to the anal segment. On each side of the dorse-median line is a dark band composed of grey or black and stippled with white; beyond this band appears another line of orange or yellow; below the latter appears a heavy, dark band stippled with white; this last dark band has a downward curve in each segment and meets the lighter colouring of the venter. The light colouring above varies from orange to yellow. The lower surface is dull grey-geeen. In this stage the larvæ move about but little.

Third instar.—Three days later, the second molt takes place and the length has increased to 7 mm. Now, the markings are quite distinct and in addition to the ones before mentioned, there appear, on each segment toward the sides, black spots, and on the second and third segments counting from the last segment there also appears one black spot on each segment. The abdominal legs and anal legs are dark, greenish yellow, while the true legs are black, except the pair of the prothorax, which is greenish yellow.

Fourth instar.—The third molt takes place three days after the second and the larvæ increases to a length of 16·5 mm. The colouring develops more or less completely. In habit the larva is now very active, moving

freely and feeding on the whole tissue of the leaves. It is to be noted that the larva is most active in feeding at night.

Fifth instar.—The fourth molt takes place three days after the third molt and the larva attains a length of 29·5 mm. It is now very soft and fat, the thorax begins to taper toward the head, the abdominal segments become thick-set and more indistinctly marked.

Sixth instar.—Two days after the fourth molt, the fifth molt takes place and the larva has now attained its full length of 35·5 mm. The thorax becomes still more tapering than in the fifth instar. The markings are well developed and distinct, except that the black transversal band on the first abdominal segment fades, leaving only a slight trace. Above, and in line with these traces and on the meso and metathorax, yellow spots are now recognizable. The full-grown larva eats voraciously. In rare instances some of the larger larvæ are cannibals, eating the smaller ones. After four days of rapid feeding the larva seeks a place for pupation. It pushes the soil aside and slowly burrows to a depth of from four to five centimeters. It then compacts the soil particles about itself, making an earthen case in which to pupate.

PUPA.

Average length of pupa 16·5 mm.; colour when fully formed darker brown; surface shiny; head smooth and rounded; eyes black and prominent; wing sheaths darker than the rest of the body; spiracles as in the pupa of *Chlorida festiva*; abdomen with three movable segments; the first two segments of the abdomen are closer and more distinctly marked than the others; the last segment is peculiarly formed, its tip is prolonged at each side into a short, stout tooth directed forward and slightly separated at tip.

The following table shows the life history of a brood of *Prodenia litura*:—

23—IV—1916	...	Copulation.
26—IV—1916	...	Eggs laid.
29—IV—1916	...	Eggs hatched.
3—V—1916	...	First molt.
6—V—1916	...	Second molt.
9—V—1916	...	Third molt.
12—V—1916	...	Fourth molt.
14—V—1916	...	Fifth molt.
18—V—1916	...	Pupated.
29—V—1916	...	Adults emerged.

37 days, length of cycle.

Sixteen newly hatched larvæ were enclosed in a jar. These were secured from the previous experiment.

3—V—1916	...	First molt.
7—V—1916	...	Second molt.
10—V—1916	...	Third molt.
12—V—1916	...	Fourth molt.
15—V—1916	...	Fifth molt.
19 to 21—V—1916	...	Pupated.
29—V—1916	...	Emergence began.
2—VI—1916	...	Emergence completed.

A third brood.

25—VI —1916	...	Copulation.
26—VI —1916	...	Eggs laid.
29—VI —1916	...	Eggs hatched.
4—VII—1916	..	First molt.
8—VII—1916		Second molt.
12—VII—1916	...	Third molt.
14—VII—1916	...	Fourth molt.
16—VII—1916	...	Fifth molt.
18 to 20—VII—1916	...	Pupation.
29 to 31—VII—1916	...	Emergence completed.

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A fourth brood.

29—VII —1916	...	Copulation.
30—VII —1916	...	Eggs laid.
2—VIII—1916	...	Eggs hatched.
5—VIII- -1916	...	First molt.
9—VIII—1916	...	Second molt.
12—VIII—1916	...	Third molt.
14—VIII—1916	...	Fourth molt.
16—VIII—1916	...	Fifth molt.
17 to 20—VIII—1916	...	Pupation completed.
25 to 29—VIII—1916	...	Emergence completed.

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A fifth brood.

12—X —1916	...	Copulation.
13—X —1916	..	Eggs laid.
17—X —1916	...	Eggs hatched.
21—X —1916	...	First molt.
24—X —1916	...	Second molt.
28—X —1916	...	Third molt.
31—X —1916	...	Fourth molt.
2 to 3—XI—1916	...	Fifth molt.
8—XI—1916		Pupation.
19 to 22—XI—1916		Emergence completed.

From the foregoing tables it can be deduced that the life cycle of *Prodenia litura* varies from 32 to 39 days. Larvæ of this species were found feeding on tobacco seedlings about the second week of October, 1916. The life history does not vary much from one season to another although it is believed, that *Prodenia* remains longer in the pupal stage during the wet season.

Food plants recorded in the Philippines by CHARLES R. JONES:*

Tomato; attacking both the leaves and fruit.

Tobacco; feeding upon the leaves.

Calabaa (*Monochoria hastata*); feeding on the leaves.

Maize; feeding upon the leaves of small plants.

Cabbage; feeding upon the leaves.

* PHIL. AGR. REVIEW, Vol. VI, Sept. 1913, No. 9

Rice ; eating the leaves.

Sweet Potato ; feeding upon the leaves.

Castor (*Ricinus communis*); feeding upon the leaves.

Jimson weed (*Datura* sp); feeding upon the leaves.

Food plants recorded for India by H. MAXWELL LEFROY,* Memoirs of the Department of Agriculture, (1908), 2: 79—93, p. 1.1.

Lucerne (*Medicago sativa*); abundant on irrigated lands.

Jute (*Corchorus capsularis* and *C. olitorius*), feeds upon the succulent apical shoots.

Indigo ; noted in August but not especially serious.

Potato ; cutting off young plants.

Mulberry (*Morus alba*), eating the leaves.

Pakur (*Ficus infectoria*), eats the leaves.

Marua (*Eleusine coracana*), scarce.

Groundnut (*Arachis hypogæa*), feeds upon the leaves.

Urid (*Phaseolus radiatus*), occasionally.

Tur (*Cajanus indicus*), feeds on leaves and pods.

Sugar cane (*Saccharum officininarum*), feeds on the leaves.

Agathy (*Sesbania aegyptiaca*), feeds on the leaves.

Coleus ; occasionally in gardens.

Dhaincha (*Sesbania aculeata*), feeds on the leaves.

From the Philippine Agricultural Review, CHARLES R. JONES, (1913) 6 : No. 9 :—

Synonymy of *Prodenia ornithogalli*, Fabr. Hamps.

Catalogue of Lopidoptera, Phalænæ in B. M. (1909, 8: 245.

Noctua litura Fabr., Syst. Ent. (1775), 601.

Noctua histrionica Fabr., Syst. Ent. (1775), 612.

Noctua elata Fabr., Spec. Ins. (1781), 220.

Hadena littoralis Boisd., Fauna Ent., Madagas. (1833), 91 pl. 13, Fig. 8: Moore.

Hadena retina Frr. Neue Beitr, (1846), 5, 161, pl. 474, Figs. 2—3; Herr.—Schaff., Eur. Schmett., Noct., Figs. 144—145.

Prodenia Tasmanica Guen., Noct., (1852), 1, 163.

Prodenia ciligera Guen., Noct. (1852), 1, 164.

Prodenia testaceordes Guen., Noct. (1852), 1, 165.

Prodenia subterminalis Wlk, (1856), 9, 10.

Prodenia galucistriga Wlk. (1856), 9, 197.

Prodenia declinata Wlk., (1857), 11, 723.

Mamestra albisparsa Wlk., Journ. Linn Soc. Zool. (1862), 6, 186.

Prodenia evanescens Butl., Mem. Nat. Ac. Sci. Wash. Rep. Eclipse Exp. (1884), 94.

Prodenia litura Fabr. (Hamps.), Cat. Dep. Phalænæ (1909), 8, 245.

* PHIL. AGR. REVIEW, VOL. VI. Sept. 1913, No. 9

TOBACCO CULTIVATION IN JAFFNA.

These notes are to be regarded as supplementary to CHELLIAH's *Tobacco Cultivation in the Northern Province* (c.f. "T.A." Vol. XL, No. 6, pp. 292-300).

Tobacco cultivation in Jaffna is essentially the industry of the small farmer. The industry has now grown to become the small farmer's especial prerogative. The owner of extensive tracts of land cannot and does not put large areas under tobacco. He finds it more profitable to lease out small blocks to labourers who farm on their own account.

For the cultivation of tobacco a good irrigation well is the first thing necessary. The farmer then puts under tobacco only that area which can be properly irrigated with a well sweep. Experience has taught him that he cannot cultivate with care an area larger than that which can hold one thousand plants. This area which is a little less than a quarter of an acre in extent now forms a definite measure of land. It forms the unit on which leases are entered upon and like the term "a plough of land" forms to the tobacco farmer the basis of all agricultural operations.

The tobacco farmer's endeavour is to sell his crop to middlemen of the local markets. The trade with Travancore has arisen from the fact that Jaffna grows more tobacco than is required by the local markets in Colombo, Kandy and Galle. The middlemen of the local markets come round in April and secure the best crops. They buy the standing crop doing all the work of harvesting, curing and grading. A good crop may fetch a price as high as Rs. 250 though this is very rare. The farmer generally refuses any offers below Rs. 150. If he fails to sell his crop to the local dealers then in May come the middlemen of the Travancore market. They are less exacting in their requirements and a good crop can easily fetch Rs. 150. With the Travancore dealers the main consideration is weight. They buy according to the weight and may themselves cure and grade the leaves. It will thus be seen that the tobacco farmer who finds a market at his very door as it were has before him one clear idea about his tobacco. It is to produce plants that will give a fairly good number of large-sized heavy leaves. For such leaves there is a steady and stable demand but it involves a system of intensive cultivation that puts out of consideration altogether the man who has the means to farm in a large way.

Whether a man with an improved method of lift-irrigation can farm a larger extent than is now done without a loss in the efficiency of his personal labour and interest is perhaps doubtful. It is a matter for experiment also whether the same results now obtained by the small farmers can be reproduced on a larger farm with improved appliances and better organization of labour. For it involves not merely a concentration of actual labour but as will now be detailed large stocks of organic manures.

Agricultural operations for tobacco commence in October when cattle are folded on the land. On this little block of land four or even eight animals are folded for three months. This is done in a systematic manner. A movable manger is constructed four feet square and four cattle are tied one to each side. This is moved daily round the field till the same ground has been covered over at least once again. The manger is covered with a roof on posts about 6 feet high and with eaves long enough to protect the animals from sun and rain. During this period of three months the animals are stall fed. Grass and straw only are fed. This is stated to cost the farmer for four head of cattle about Rs. 30.

In January the block is manured with green leaves. This is very scarce now in the Peninsula and has to be got from the islands. Two cartloads of green manure are considered to be the least amount necessary. It was difficult at the time to ascertain the weight of this stuff. The manure is sold in

bundles and each cartload contains about 60 bundles. The green leaf preferred to all others is "Kavilai" (*Tephrosia purpurea* Pers.), this costs 10 cents a bundle. Others considered as good are "Pavaddai" (*Pavetta indica* L.) and "Adatodai" (*Adhatoda vasica* Nees.). Some are disposed to consider the latter two as even superior to the former but there is much conflict of opinion. "Puvarachu" (*Thespesia populnea* Soland ex Corr) is a 2nd grade manure and costs 6 cents a bundle. "Vempu" (*Azadirachta indica* A. Juss) is sold at 4 cents a bundle and is rarely used unless green manure is very scarce. This is considered a very "hot" manure. It takes a long time to decay. If applied it is put into the ground in September-November during rainy days.

The dried green leaves of palmyrah used for thatching roofs are also applied after they have been on the roof for about two years.

Before applying the green manure the ground is dug to a depth of about 9 inches. This will take two days for one man to do. After this the clods are crushed and a ploughing may also be done. The green manure is then buried in trenches, the work taking about three days.

The next operation is to fold sheep and goats on the land. One hundred goats are fenced in an enclosure that will be taken up by 50 plants, for one night. In this way the whole block is manured with goat dung. Next the whole land is worked to a fine tilth with mamoties and is ready by February for the transplanting on to it of the tobacco seedlings.

The seedlings, grown in a nursery in which seed were sown about the middle of October, are transplanted out in February. Throughout the whole month great care is taken to ensure a sturdy vigorous growth. The plants are shaded and watered carefully and the ground clean-weeded.

In March the whole ground is dug over with a pointed stick or weeding knife and cattle manure is spread over or sheep are penned among the plants. Square basins take the place of the round basins and the plants are irrigated every alternate day.

In April, after another stirring of the soil the plants are ridged both lengthways and crossways so that a shallow basin is formed with the plants at the four corners. Water is let in by breaking a ridge in the middle and filling up the basin. This irrigation is conducted on alternate days.

Topping is done in June and the crop is harvested in July-August. For these details CHELLIAH's article may be consulted.

Some of the varieties of tobacco recognised by the farmer are as follows:—

(1) *Karuthikoman* (the "black pointed leaf"). There is a large and small sub-variety of this type. Leaf is dark green, broad with an acute acuminate apex. Good sized leaves measure 3 ft. × 2 ft.

(2) *Vennaithuvarkuruhu*. Veins like that of a coconut leaf. Leaves brittle. Good for chewing tobacco, veins strong but leaf delicate and brittle. Leaves break down with heavy shower. Tobacco considered of very good quality. Good leaves 3 ft. × 1½ ft.

(3) *Manjalkoman*. Pointed like (1) only a bright apex. Considered the best variety. Internodes short. Leaves measure 3½ ft. × 1½ ft.

(4) *Thalivan*. Another bad variety. Internodes are not so short as the former. Petiole very slender. Leaves 2 ft. × 1 ft.

(5) *Karruthikolyan*. Like (1) only a blunt apex. Considered the best type. Leaves are even larger and darker in colour.

(6) *Saraivalan* (Like a "ratsnake's tail"). This is very much like (2) veins are smaller and the leaf is narrower. Leaves 3½ × ft. 2 ft.

(7) *Pellivirumbai*. Leaf is the lightest of all varieties in colour. Measure 3 ft. × 2 ft.

H. J. VAN BUREN.

FOOD STUFFS.

THE GROUNDNUT.

W. D. KERLE,
Assistant Inspector of Agriculture, and Experimentalist,
Hawkesbury Agricultural College.

(*Continued from page 269*).

ROTATION SYSTEMS.

A proper system of rotation should be followed with peanuts (groundnuts) as with other crops. To retain the soil fertility—which is dependant on so many factors—unimpaired, it is necessary to follow a rotation suited to the soil and climatic conditions. The growth of any crop on the same ground for several seasons is known to result in lowered production, it is even undesirable to include in a rotation two or more members of the same family, since the probabilities of inroads due to crop diseases are increased.

The following cropping systems are suggested for the districts concerned, the times of sowing being approximate only.

North Coast.—In this district, where dairying, pig-raising, maize and potato-growing are the main agrarian industries, the following rotations are suggested :—

I.—1st Year, Potatos (main crop), sown July-August.
" Cowpeas sown December, and ploughed in.
2nd Year, Maize (main crop), sown September.
3rd Year, Fodder Crop, sown April, fed off.
" Peanuts (main crop), sown September-October.

This is a five-course rotation, in which a main crop of peanuts would be sown every third year. To ensure the soil being in better condition, the fodder crop (barley, wheat, etc.) could follow the potatos, and the cowpeas could be broadcasted in the maize at the tasselling period, and ploughed in after the maize has been harvested.

II.—1st Year, Potatos (Autumn crop), sown in February.
" Peanuts (main crop), " September.
2nd Year, Fodder Crop (barley, etc.), " May.
Maize (main crop), " September.

In this rotation it may be preferable to follow after the peanuts to ensure favourable planting conditions for the maize. The autumn sowing of potatos is limited to certain districts, owing to the climatic conditions at that time being favourable to the spread of Irish Blight.

III.—1st Year, Maize (main crop), sown September.
2nd Year, Peanuts, " September-October.

This is a simple, two-course rotation for localities where potatos are not profitable.

At the present time, while the market for nuts for roasting is limited they can be grown for pig-raising. For this purpose the following systems are suggested :—

IV.—1st Year, Maize (main crop), sown September.
,, Peanuts (for pigs), ,, December.

The maize would be sown about September, and in the last cultivation, just before the tasselling stage, the peanuts would be sown between the rows. After the maize was harvested, the cattle would be turned in to eat the peanut tops and maize stalks, and after them pigs to unearth the nuts.

V.—1st Year, Maize (main crop), sown September.
,, Cowpeas, sown December and ploughed in.
2nd Year, Maize (main crop), sown September.
,, Peanuts, sown December and foraged by pigs.

In this system the cowpeas would be sown in the maize just prior to the tasselling period, and ploughed in about March or April. The succeeding crop of maize would be sown with peanuts and foraged by pigs in a similar manner to that in the preceding rotation.

Numerous rotations of the above kinds could be suggested to include also other crops, such as sorghum, sweet potatos, pumpkins, turnips, etc. The farmer would be guided chiefly by the market for his crop as to which would best suit his particular requirements. It is advisable, however, only to sow the main crop of peanuts once every two or three years, and it should, if possible, follow a crop which has been kept well cultivated and free from weeds.

The Central and South Coast.—The climatic conditions of these districts somewhat militate against the peanut as a main crop. However, it is more than possible that it would be a payable proposition, judging by the yields obtained at Hawkesbury Agricultural College. The rotations to adopt might be similar to those for the North Coast district, the times of sowing being relatively later.

The Murrumbidgee Irrigation Area.—It is suggested for this district that peanuts could be successfully grown between the young fruit trees. They could be fed to pigs or harvested for the market, and in either case would be beneficial to the young orchard, particularly if the main portion of the roots, rich in nitrogen-bearing nodules, were left in the soil. They could be sown with a cereal crop in alternate years as main crop sowings.

VI.—1st Year, Sudan Grass (for soiling or hay), sown October.
2nd Year, Fodder Crop (for ensilage or feed), sown May.
,, Peanuts (main crop), sown October.
3rd Year, Fodder Crop (for ensilage, etc.), sown May.
,, Maize (main crop), sown October.

This intense rotation is suggested where dairying is practised, and it has peanuts as one of the main crops.

If the market demands bright nuts and only red soil is available, this rotation could be modified by sowing maize in October of the second year and planting peanuts between the rows just before the tasselling stage, and allowing cattle and pigs to forage the fodder as recommended above.

MANURING.

The amounts of the principal plant-food constituents required by a 60-bushel crop of peanuts, calculated from data reported by the Tennessee Experiment Station, U.S.A., are given below :—

		Lb. per acre.			
		Nitrogen.	Phosphoric Acid.	Potash.	Lime.
Peanuts with hulls ...	1,380 lb.	44·22	9·08	12·73	4·66
Peanut hay ...	2,000 lb.	40·49	5·72	19·57	41·64
Total weight of crop	3,380 lb.	84·71	14·80	32·30	46·30

Although the above figures do not indicate the exact proportion of manurial constituents a fertiliser for peanuts should contain, they serve as a guide in formulating a suitable mixture of mineral fertilisers.

The power possessed by the order of plants to which the peanut belongs *(Leguminosæ)*, of utilizing the free nitrogen of the atmosphere in their life processes, renders the application of nitrogenous fertilisers of little value. In soils deficient in humus it is advisable to furnish a small percentage of nitrogen, in order to supply the young plant's requirements until its vital processes are sufficiently developed to permit it to dispense with assistance.

Responding, as the peanut does, to the use of commercial fertilisers, the following formulæ are recommended for general use, and are particularly suitable for light, sandy loams :—

I.—Superphosphate ... ... 88 lb. per acre.
Sulphate of Potash ... ... 62 ,,
Dried Blood (or Sulphate of Ammonia, 15 lb.) 22 ,,

This complete fertiliser, applied at the stated amounts per acre, will cost approximately 17*s.* 6*d.*, and will supply :—

Phosphoric Acid ... ... 15 lb.
Potash ... ... 32 ,,
Nitrogen ... ... 3 ,,

Bone-dust may be substituted for superphosphate in a mixture consisting of—

II.—Bone-dust ... ... 68 lb. per acre.
Sulphate of Potash ... ... 62 ,,

This would give the same amounts of phosphoric acid and potash as above, and practically the same amount of nitrogen. In most soils this quantity of nitrogen would be sufficient to give the young plants the impetus they require.

It is essential for the proper development of the peanut, that the lime-content of the soil be comparatively high. The soil need not be naturally calcareous, but it is imperative that the deficiency be made up by applications of lime in some form, since it is also necessary to a satisfactory mechanical condition of the soil, to assist in liberating unavailable plant food, and as a base for the bacteria contained in the root tubercles, whose function is the assimilation of atmospheric nitrogen. Lime is most economically applied in an air-slaked condition. Dressings of 15 to 20 cwt. should be worked into the surface soil, preferably in the autumn, at least three weeks before sowing. It should never be applied at the same time as manure or fertilisers containing nitrogen, or there will be a heavy loss of that valuable ingredient. The presence on the land of sedges, sorrel, rushes, etc., is indicative of badly drained and therefore sour land, requiring liming and artificial draining before peanuts can be sown with any measure of success.

Farmyard manure tends to produce luxuriant foliage but badly-filled pods, and unless well rotted, it may cause the ground to become infested with weeds. It is, therefore, only advisable when the soil is deficient in humus, and then it should be applied for preference with the preceding crop. The bacteria, which live in symbiotic relationship with peanuts, as with all legumes, are usually sufficiently abundant in the soil; but if the development of nodules is meagre, it would probably be found advantageous to artificially inoculate the soil, since its ability to produce large yields must depend to a very considerable degree on the prolificacy of these rhizobia.

THE SEED AND SEED SELECTION.

The seed for the first season's crop must be obtained from a reliable source, and consist of well matured, perfect nuts, if possible acclimatised. For subsequent sowings, the grower will retain some of each year's crop, practising selection with as much care, if not more, than he does for his maize crop. Increased yields invariably follow the selection of mature, well-filled, even peanuts from the most prolific plants. This should be done in the field at harvest time, and will amply repay the trouble. The nuts selected for seed must be thoroughly dried and stored during the winter, in a well-aired barn, or hung in bags where the air can circulate freely among them. Overheating, and consequent injury to the germ, results from improper curing and drying. They must be harvested and cured without being frosted, or partial, perhaps total, loss of vitality will result.

It is advisable to shell the nuts before sowing, for the following reasons :—

1. A better stand results, since shelling eliminates the danger of sowing immature or badly filled pods.
2. Overcrowding—which results if two or more kernels germinate—is avoided.
3. Uniformity of germination.
4. Earlier maturity.
5. Economy of seed.

Small varieties, such as "Spanish"—the pods of which are invariably well filled—are usually sown without shelling, since overcrowding, and the fact of being a few days later in germinating, is of no great consequence.

The nuts can be most satisfactorily prepared for sowing by hand-shelling owing to the danger of injury to the germ by machinery. Care must be taken to avoid rupturing the red skin (testa) of the nut, and to discard all small, shrivelled, mouldy, or otherwise imperfect kernels.

"The manner in which unshelled nuts germinate is rather curious. The germination of the kernels is not simultaneous. One germinates first, and its radicle penetrates the pod; the plumule growing upward carries with it the other kernel covered by the shell not yet germinated; this kernel is forced nearly to the surface of the soil, falls to one side, and then germinates. The process occupies six to eight days, and if the surface moisture of the soil has then dried up, the second kernel has difficulty in germinating unless rain falls."*

VARIETIES.

The varieties of peanuts in general cultivation are variously classified, according to the habit of growth and the size of the pea; some have an erect, bunched habit, while others possess spreading branches, which lie flat on the ground. The former are more generally grown since they can be sown closer together and are easier to cultivate and harvest.

Large podded varieties are more select in their soil requirements and more apt to produce unfilled pods if the conditions are not quite satisfactory. Generally speaking, the small nuts are hardier, and better adapted to adverse soils and climates.

* BULLETIN OF THE IMPERIAL INSTITUTE, Vol. XIV, No. 3, p. 473.

The varieties which have been tested in departmental trials were introduced from the United States of America, with the exception of one variety which has been termed "Local," and whose origin is not known; it was probably imported by Chinese gardeners from their native land. The only other varieties which have come under the notice of the Department are a large podded variety similar to "Local," called "Giant," and the dwarfed variety usually grown and retailed by Chinese gardeners.

Although the American varieties have given results which evidence their adaptability to our soils and climate, it must be admitted that none of them quite equal for roasting purposes the nut imported from China and Japan. They answer the requirements of the trade for confections and oil extraction, but since the demand is, in the first instance, for roasted peanuts, more suitable varieties may have to be found to supply this demand.

The varieties which have been under trial by the Department of Agriculture in this State may be described as follows :—

Spanish.—This is a strong-growing, very hardy variety, with small pods about 1 inch in length; foliage fairly abundant, and stems erect. The pods are borne in a compact cluster centred about the tap root, to which they firmly adhere in harvesting. Each pod is completely filled by two light brown peas. The kernels are small, but sweet and well flavoured, and are in strong demand by confectioners. Unfilled pods are very rare. It is the earliest of the varieties tried, maturing in from 100 to 110 days. It is very prolific, yielding at Grafton Experiment Farm as high as 121 bushels per acre. Spanish is very drought-resistant, and will thrive under a wider range of soil and climatic conditions than other varieties. On account of its diminutive size and invariably well-filled pods, it is rarely shelled for sowing. The foliage makes excellent hay, but is not so abundant as in the larger podded varieties. Spanish is grown largely for the shelled peanut trade, and for the manufacture of peanut butter and confections.

The oil content is 7 to 10 per cent. higher than most other commercial varieties, and for that reason it is a variety that is extensively favoured for oil production. Thirty pounds of high-grade nuts will yield one gallon of first-class oil and 20 lb. of meal of high feeding value.

Valencia.—This variety has given the most consistent results, if not the highest individual yields, of the varieties imported from the United States. It has a bunch habit of growth, the foliage being very abundant and of a dark green colour. The pods are medium-sized, clean and bright, containing three to five tightly-packed, dull red-coloured nuts of excellent flavour. They are clustered principally around the tap root, and adhere well to the vines in harvesting. The highest yields obtained were 112½ bushels at Grafton Experiment Farm in 1915, and 107¾ bushels at Yanco Experiment Farm in the same year. The average yield of this variety at the former farm for three years was 91¼ bushels. It has invariably given good results in a diversity of soils and under variable weather conditions. Undoubtedly drought-resistant, its luxuriant growth of soft, leafy vine is particularly valuable.

Samples of this variety were submitted to a Sydney firm for roasting, and were reported to be "equal in flavour to the best imported nuts, and suitable for the trade." The small size and dark red colour of the kernels, however, rather detract from the value of the variety for this purpose. On account of their superior flavour, the nuts are keenly sought for by confectioners. It is a mid-season variety, maturing in about 120 days. The weight per bushel is 22 lb.

Virginia Bunch.—This, as the name implies, is a bunch type, with large pods of irregular shape, 1½ inches to 2 inches in length, foliage abundant, and of a light green colour. The pods are of bright appearance, and are developed around the base of the plant. The nuts, of which there are usually two in a pod, are held loosely, and are of a light brown colour.

It was observed in the trials that the percentage of unfilled pods or "saps" was comparatively high. Virginia Bunch is used extensively in the United States for roasting; but samples submitted to a Sydney merchant were considered unsuitable, for "not only were the nuts of inferior flavour, but the shells varied in thickness at the ends, and consequently were very difficult to roast." The variety gave a yield at Grafton Experiment Farm in 1913 of 124½ bushels per acre, but in view of their inferior roasting qualities, trials were discontinued from that year. A bushel of this variety weighs 22 lb.

Local.—The history of this variety is not known. It has been employed in trials as a "check" variety for comparison with those introduced from America. It is large podded, with strong-growing, coarse, creeping stems, along which the pods are borne in profusion. The pods are large, 1¼ inches to 1¾ inches in length, irregular in shape, and containing, on the average, two pink-coloured nuts of medium flavour. Its yield at Yanco Experiment Farm in 1915 was exceptional—118 bushels—but this has not been supported by similar yields at other farms. The variety matures earlier and is lower in oil content than Valencia. As a drought-resister it is much inferior to the American varieties, as was evidenced by the 1915 trials at Grafton Experiment Farm. Samples submitted for roasting were reported to be "rather hard and dry eating." It seems to be characteristic of this variety to produce a large percentage of "saps." This defect has been consistently noticed at all the experiment farms; the imported varieties grown under the same conditions have given excellent results, which seems to indicate a varietal weakness.

Generally speaking, Local has proved inferior to the introduced varieties in point of yield and quality. Owing to its spreading habit of growth, it is more difficult to harvest than the bunch type. It produces abundant foliage, which cures well as hay. The bushel weight of the variety is 22 lb.

The following varieties have not yet been introduced into this State, but are commercially successful in the United States of America.*

Virginia Runner.—This is a large-podded, strong-growing variety, with creeping stems and heavy foliage. The pods are scattered along procumbent stems, and do not adhere well in digging. The nuts are similar to Virginia Bunch.

Tennessee Red.—This is a small-podded variety, similar to Valencia, but of inferior quality. The pods are medium in size, containing five or six peas crowded together. The nuts are covered with a dark red coloured testa, which lowers their market value considerably. The variety is well adapted for stock feeding. It is somewhat similar to Valencia in appearance.

African or North Carolina.—This is a rank-growing procumbent variety, with dark green luxuriant foliage. The pods are scattered along the stems, and are medium in size, usually containing two peas. These are rich in oil, and are of excellent flavour. It is a late maturer. In Africa it is extensively grown for oil production.

Running and Bunch Jumbo.—These are two varieties which differ only in their habit of growth, as the names imply. The pods are similar to those of Virginia Bunch, but have a greater tendency to produce "saps." They are chiefly grown for roasting purposes, but are gradually being superseded by more reliable yielders. The period of maturity is approximately 160 days.

TIME OF PLANTING.

Peanuts are planted in the spring of the year, but not until all danger of late frost is over and the soil is warm. If the ground is cold, germination

* FARMERS' BULLETIN 431, U.S. Department of Agriculture

will take place slowly and irregularly. The Departmental experiments indicate that the most suitable times for sowing the main crop are :—

North-Coast : September—3rd and 4th weeks.
Central Coast : October—1st and 2nd weeks.
South Coast : October—2nd and 3rd weeks.
Murrumbidgee Irrigation Area : October—2nd and 3rd weeks.

Being more susceptible to frost, and requiring a warmer soil for its successful germination, the peanut crop should be sown a little later than for main crop maize sowings. The Spanish variety is early in maturing, and can be sown two or three weeks later. As far as possible, the sowing should be arranged so that the crop will be harvested when dry weather can reasonably be expected.

QUANTITY OF SEED.

To sow an acre, 27 to 35 lb. of unshelled nuts, or 8 to 10 lb. of shelled nuts, are required. The quantity depends chiefly on the variety, the distance apart in the rows, and the width of the drills. The small-podded varieties, such as Spanish, usually sown without shelling, require 1 bushel (in the pod) per acre. If these small varieties are shelled, 7 to 8 lb. of seed will be required per acre.

METHODS OF SOWING.

The method adopted in small areas is to mark out the ground in drills with a hand plough, drop the seed by hand, and cover with the plough or rake. On extensive areas, where the peanut crop has taken a permanent place in the rotation of the farm, and is, perhaps, the chief source of revenue, the use of machines becomes necessary. The land is marked out in drills, as for maize, but not so deeply, using an ordinary plough or one of the special drill ploughs on the market. The distance apart of the drills will depend upon districts and on varieties. In typical districts, drills 3 feet apart and seeds every 18 to 24 inches in the drills is sufficient for the strong-growing varieties, such as Local ; for medium varieties, such as Valencia, 2 feet 9 inches between drills, and plants 15 to 18 inches apart, will be found satisfactory ; while for small varieties, such as Spanish, drills separated by 30 inches and plants by 12 to 15 inches will give satisfaction.

In the United States the seed is sown by a special peanut planter, similar in many respects to the maize-dropper. The implement is not fitted with a fertiliser attachment, but special machines for marking out the land and applying the fertiliser are on the market. These are very reliable, and are great labour-saving appliances.

Very satisfactory work can be done with the ordinary maize-dropper by fitting special plates. The chief danger is that the nuts may be broken, but this can be obviated by careful adjustment. If the seed has been graded and the machine properly set, single nuts will be dropped uniformly at the set distance. To the front of the dropper may be attached mould-boards, so that the furrows may be run out and the seed and fertiliser sown in the one operation. This is particularly advantageous in hot localities where the drills are apt to dry out quickly. It ensures the seed being deposited in moist soil, and effects a saving of labour. Machines for sowing nuts in the pod have not yet been widely adopted. Unshelled nuts may be dropped by hand in the drill, and covered by a single cultivator with mould-board attachments or by two broad tines attached to the adjustable side-standards.

The seed should be covered to a depth of 1½ inches in sandy soil and 1 inch in heavier soil if it is in a fine moist condition. Slightly deeper covering will be necessary if the soil is inclined to be dry at the surface.—Agricultural Gazette of N.S.W., April 2nd, 1918.

(*To be continued*).

CEYLON AGRICULTURE.

THE BOARD OF AGRICULTURE.

A meeting of the Board of Agriculture was held at 12-30 p.m. on Tuesday, the 21st May, at the Executive Council Chamber at Queen's House. His Excellency the ACTING GOVERNOR presided, and those present were:—The Hon. Sir S. C. OBEYESEKERE, Sir S. D. BANDARANAIKE, the Hon. Messrs. C. S. VAUGHAN, O. C. TILLEKERATNE, J. H. MEEDENIYA and ABDUL CADER, Dr. H. M. FERNANDO, Lieut.-Col. T. G. JAYAWARDENE, Messrs. F. A. STOCKDALE, B. HORSBURGH, E. B. DENHAM, A. B. THOMSON, H. F. MACMILLAN, TUDOR RAJAPAKSE, A. E. RAJAPAKSE, H. L. DE MEL, W. A. DE SILVA, J. D. VANDERSTRAATEN, A. W. BEVEN, GERARD JOSEPH, A. P. GOONATILLEKE, and C. DRIEBERG (Secretary).

The minutes of the last meeting were read and confirmed.

THE LATE SIR JOHN ANDERSON.

H. E. the ACTING GOVERNOR said: The first item on the agenda is that a vote of condolence be passed on the death of H. E. Sir JOHN ANDERSON. It is unnecessary for me to say much on this motion. We are all aware of the interest which His Excellency took in the Society. I think that one of the last of his public appearances was when he presided over a meeting of this Board, and I know that the interests of Ceylon agriculture occupied a considerable part of his attention. I propose: "That this Society desires to place on record its deep regret at the loss which this Society, the Colony and the Empire have suffered by the death of Sir JOHN ANDERSON, and to express the Society's sincere sympathy with His Excellency's family in their bereavement."

The vote was carried in silence, the members standing.

THE LATE SIR HENRY BLAKE.

Mr. E. B. DENHAM said: "It is my privilege to move a vote of sympathy and condolence with the relatives of Sir HENRY BLAKE. As members are aware Sir HENRY was the founder of this Society and I was associated with him from the beginning of the work of the Society. It is unnecessary for me to remind members of that charming personality, that fine figure of a man, or the interest he took in the Society. Sir HENRY had always found time to organise shows, and time to attend to the work of the Society. In fact, from the very inception of the Society Sir HENRY had taken a great, personal interest in agriculture. He had also a great personal interest in the people of the country. Those who knew him, and what he had done for the Island's agriculture, mourned not only a great agriculturist, but a man who was also a great gentleman."

The vote was carried in silence, all standing.

PROGRESS REPORT.

The SECRETARY next submitted the Progress Report, and gave a brief summary of it to the meeting.

SPECIMENS OF VEGETABLES.

Mr. A. B. THOMSON exhibited a few specimens of brinjals he had grown both from seed obtained from the Agricultural Society and from the neighbourhood of his estate, and provoked some amusement when he declared that the large variety was from seed collected from round about the estate, while the small variety, which bore no comparison to the other, was bought from the Agricultural Society.

The DIRECTOR OF AGRICULTURE explained that the Society had had great difficulty in obtaining supplies of seed, and the point brought forward by Mr. THOMSON emphasised the importance of having a regular source from which the Society could get supplies. The Society had during the past few months entered into a contract with a reliable grower for the supply of seeds from Matale, but if Mr. THOMSON was prepared to consider the matter the Society would be quite disposed to consider a contract for seed from him.

Mr. THOMSON remarked that he had all his brinjals in different plots and when they were ripening he could keep them for the Society, if desired.

EXTENSION AND CO-ORDINATION OF AGRICULTURAL SERVICES.

The next item on the agenda was the consideration of the Report of the Committee appointed to investigate the proposals of the Director of Agriculture for the extension and co-ordination of the Agricultural Services of the Colony.

The DIRECTOR OF AGRICULTURE remarked that at the last meeting a Committee had been appointed to consider the proposals set forward in Sessional Paper No. 1 of 1918. That Committee had submitted a report which had been in the hands of members for some days. It agreed generally with the principles and proposals laid down in the report, but made some suggestions in regard to it. First of all the Committee suggested that the whole of the scheme should not be brought into force at once, but that the appointment of Provincial Agricultural Organizations should be gradual. The Committee also urged that in addition to the Provincial Agricultural Schools, which it was proposed should be of an elementary nature, there should be a higher course at Peradeniya to which the most successful students in the Provincial Schools might go. The Committee had also made some suggestions in regard to salaries for certain posts. The question of the amalgamation of the Department of Agriculture and the Society had been considered and the Committee had recommended that the amalgamation was in the best interests of the agriculture of the Colony. The Committee, however, suggested that some Association, to bring together all those interested in the agriculture of the Colony, should be formed. This Association should be responsible for holding conferences annually or more frequently. There is an example in the Engineering Association of the Colony and the Committee considered that agriculturists might with advantage form an Association or Society on a similar basis. The question of a name for such

an Association had been considered and the majority of members were in favour of continuing the title of Ceylon Agricultural Society rather than bringing in the new title of Agricultural Association. Those were the main items in the Report. Mr. STOCKDALE concluded by saying that in order to have the report printed in time for the meeting, the Hon. Mr. RAMANATHAN'S name had been included, although at that time Mr. RAMANATHAN had not sent in a signed copy of it.

SIR S. D. BANDARANAIKE moved the adoption of the report—a report which had been prepared after considerable consideration.

The Hon. Dr. FERNANDO seconded and said in further explanation of the observations made by the Director of Agriculture, the Central College proposed not only to train some of the advanced students of the Provincial Schools but also to train the subordinate staff of the Agricultural Department to be. With regard to salaries, the Committee had brought it into harmony with India. Although India was a cheaper country it had failed to attract men on smaller salaries.

Mr. THOMSON asked whether the two years' course was going to be over and above the school course and who was going to pay—Government or the individual?

Mr. T. G. JAYEWARDENE said he wished to add his tribute of praise to the Director of Agriculture for the comprehensive scheme he had promulgated to further the agricultural interests of the Island. The masterly and courageous manner in which the Director had dealt with the subject had evoked their admiration. It had been submitted to all the agricultural bodies of the Island and the fact that it had been passed untouched spoke volumes for the ability with which the Director had dealt with the subject and his quick and sound grasp of Ceylon's agricultural requirements. It augured well for the future.

The CHAIRMAN, replying to Mr. THOMSON, said that the question was one which involved considerable detail, but that a Scholarship scheme had been suggested and would receive consideration from Government.

AGRICULTURAL SHOWS.

The DIRECTOR OF AGRICULTURE submitted the report of the Committee appointed to report upon regulations for conduct of and judging at Agricultural Shows and moved that it be adopted. This motion was seconded by Mr. G. A. JOSEPH, and unanimously carried.

SUGAR-CANE CULTIVATION.

The following motion by the DIRECTOR OF AGRICULTURE was adopted:—"That a Committee of the Board of Agriculture be appointed to consider the prospects and possibilities of sugar-cane cultivation and of the manufacture of sugar in the Colony of Ceylon." The following Committee was appointed:—The Hon. Dr. H. M. FERNANDO, the Hon. Mr. O. C. TILLEKERATNE, Messrs. H. L. DE MEL, A. W. WINTER, A. W. BEVEN, KELWAY BAMBER, T. G. JAYEWARDENE, the DIRECTOR OF AGRICULTURE and C. DRIEBERG (Secretary).

The meeting then terminated.

PROGRESS REPORT No. LXXV.

OBITUARY.

The Society mourns the loss of its Founder Sir Henry Blake and of its late President Sir John Anderson., G.C.M.G.

MEETINGS.

The last meeting of the Board was held in Colombo on 25th February, 1918, and was presided over by the Hon'ble the Colonial Secretary.

The Special Committee appointed at that meeting for the consideration of the proposals by the Director of Agriculture for Co-ordination and Extension of Agricultural Services of the Colony held two meetings and their report is being submitted to the Board.

MEMBERSHIP.

The following joined since the last meeting:—B. Owtram, E. Africa; E. H. Kirby, Malacca, S. S.; The Conservator of Forests, Siam; D. M. Rajapakse; Jas. D. Dunlop; A. Wijewante; M. Thams, British East Africa; V. R. Runade, Poona City; Geo. Mampilly, Coorg; The Superintendent, Atagalla Estate, Gampola; A. H. Healey; S. Weerackkody Mudaliyar; Felix. R. Dias; P. J. Benwell; W. G. Bolton, Penang; Messrs. V. K. Sankara Menon and K. Kochagovinda Marar, Trichur and Charles Harquelle.

STAFF, INSPECTIONS, ETC.

Mr. Madanayake from Galle has been transferred to Matale and will assist the work being carried on by the Matale Food Production Association. Mr. Karunanayake has the whole of the Southern Province assigned to him.

All the Instructors have been inspecting the new areas under food products, vegetables and currystuffs.

The Organising Vice-President visited the following places:—Mawanella, Anuradhapura, Mawatugoda, Colombo, Nuwara Eliya, Kalutara, Galle, Nagoda, Weligama, Matara and Harasbedde.

The Secretary visited the following:—Weuda, Kurunegala, Wariapola, Hettipola, Digalle, Kuliyapitiya, Nakawatte, Atamune, Ibbagamuwa, Kumbukwewe, Gokarella, Medamulla, Baluwella, Colombo, Beligammana, Galle, Weragoda, Matara, Weligama, Tangalle, Ranna, Kuila, Ambalantota, Hambantota, Tissa, Nakulugama, Gandera, Kesbewa, Ruanwella, Bandaragama, Alutgama, Jambureliya, Ukuwela, Matale, Suduganga, Kaikawela, Paldeniya, Tenne, Marukona, Alawatugoda.

INCREASED CULTIVATION OF FOODSTUFFS, VEGETABLES AND CURRYSTUFFS.

Very full and interesting reports—called for at the instance of the Organising Vice-President—on the result of the first season's efforts to increase the cultivation of these crops are now coming in from the Agricultural Instructors.

Of new food crops, dhall is the most promising, and reports from all quarters are satisfactory. The crop is, of course, best suited to drier areas though it has been found to thrive well wherever it was tried.

The extension of vegetable cultivation is general and the utilisation of waste pieces of land for this purpose is very noticeable.

Of currystuffs, coriander and anise were the most successful, fenugreek and cumin the least. Further trials are necessary with these new products. Chilli cultivation is spreading but not as rapidly as it might. The output of curry onion (shallot) is increasing with every season.

Through the initiative of the MUDALIYAR of Siyane Korale East, a Society has been started with a view to opening a number of gardens for demonstrating the cultivation of foodstuffs, vegetables and currystuffs. The Agricultural Instructor, Kalutara, who is co-operating with the promoters, reports that about 100 members have joined the Society and pay a subscription of Re. 1/- a month to meet the expenses connected with the upkeep of the Gardens. Four gardens, varying from 1 to 3 acres, have so far been taken in hand.

The work done by the Matale Food Production Association promoted by two members of the Board (MESSRS. SENIOR-WHITE and A. B. THOMSON) is notable. With the sympathetic interest shown by the Assistant Government Agent, Matale, the operations of this Association are likely to result in the cultivation of extensive areas hitherto lying waste.

SHOWS.

Beligammana Show (25th and 26th February).

The fruit section was not well filled : limes and pumelos were the best exhibits. The collections of yams and tuberous crops generally were remarkably good. Locally manufactured agricultural implements, including mammoties, catties, knives, etc. were a novel feature.

Prizes were awarded for the best School Gardens as well as Villagers' and Children's Home Gardens. The teacher of Beddewela School showed a model School Garden on the premises.

Ruanwella Show (5th and 6th March).

Considering the season the exhibits of fruit were very fair : the prize pineapples weighed 19 and 16 lb. The vegetable section was much better, and many excellent specimens of low-country vegetables were shown : brinjals, chillies and gourds were exceptionally fine. Sweet potatos, yams, cassava, tanias and arrowroot were well represented.

Cereals and pulses made up another good section, and included some well-grown local dhall. Currystuffs (including coriander and anise grown in the district for the first time) made a good show.

The prize for School Garden produce went to the Ruanwella School, which was also responsible for over 200 exhibits sent in by boys from their home gardens.

Mawatugoda Show (16th and 17th March).

The exhibits at this show totalled 2,500. The vegetable section as a whole was good. Yams and other tubers were of excellent quality though not numerous. Good specimens of oranges, mandarins and limes were shown. Currystuffs were represented by dried chillies, coriander and anise. Among prepared products were exhibited good specimens of papain.

Full reports of the above three Shows have been published in the TROPICAL AGRICULTURIST for April.

Health and Public Welfare Exhibition, Colombo, (20th to 24th March).

At this successful show, organised by the Ceylon Social Service League, Colombo, the section dealing with local food production was under the direction of the Society. A large series of exhibits illustrating food, vegetable and currystuff crops was on view. A feature of this section was a labelled collection of growing economic plants in boxes and pots. Literature dealing with their cultivation and packets of seeds were also available.

The Secretary of the Society, the Senior Agricultural Instructor and the Foreman of the Government Stock Garden were responsible for the preparation and arrangement of the exhibits.

Nuwara Eliya Show (12th and 13th April).

Owing to the change of dates originally fixed for this Show, and its coincidence with the Sinhalese New Year, neither the attendance nor the number of exhibits (particularly in the Native Products section) were up to the usual standard. The Organising Vice-President and the Secretary of the Society acted as referees in judging the economic products. The "English Vegetables" were well grown and well shown.

In the miscellaneous products section MR. J. D. VANDERSTRAATEN showed a fine sample of coconut oil extracted from the fresh nut by a new process, which, besides yielding a dry poonac, also produces an edible substance which has been temporarily labelled "coconut caseine" which MR. VANDERSTRAATEN is hopeful may prove a valuable ingredient in the manufacture of prepared foods. Specimens of this substance are on view to-day.

Nildandahinna Show which was to have taken place on 27th April, was fixed for May 11th and 12th, and Dedigama show for 18th and 19th May.

Other Show fixtures are :—

Wadduwa	...	... 1st June
Wewita	...	... 29th June
Tihagoda	...	... 6th July
Bellana	...	... 17th July
Weligama	...	... 27th July

Arrangements are being made to hold a Public Welfare Exhibition in Kandy probably next August. This will include an agricultural section.

EXPERIMENTS.

The Senior Agricultural Instructor reports that very encouraging results were obtained at Yatiwawela in Harispattu in a "transplanting" experiment. 3/5 bushel seed was sown in a nursery and the seedlings transplanted on to ½ acre of land, two plants being put together 6 in. apart. The yield was 40 bushels and there was a saving of 2/5 bushel of seed paddy.

MR. C. D. A. GUNEWARDHENA, Secretary, Akuratiya Co-operative Credit Society, has forwarded a report on his plot trials with Burmese Water-resisting paddy. Seed was put down in a nursery on September 5th and transplanted on October 15th and harvested February 15th, 1918. This gave a promising crop which was unfortunately badly attacked by birds. In this locality there was no flood during last N.E. monsoon season—the first time in the memory of village cultivators.

MR. SENIOR-WHITE suggests that trials should be made with locally raised Coriander seed, as his cultivation with local seed was not successful. With reference to Dhall he reports: "67 plants put 6 ft. × 6 ft. gave 96 lb. of cleaned seed. Of Ginger he says: "the area planted was too small to get out any "per acre" figures of value; the return was only four-fold."

In the trials with shallot at Uduwawela a yield equivalent to 12,000 lb. per acre was obtained.

INTRODUCTIONS.

A small quantity of *Sadai Samba* paddy was received from the Manager, Palur Agricultural Station (S. India). This is described as a fine wet-land variety which takes about 6 months to yield a crop. It is being tried at Peradeniya and Harispattu.

A bag of *Klang Pi* paddy has been received through the courtesy of H. R. H. RAJABURI, Minister of Agriculture of Siam. This is reported to be a hardy variety producing a long grain which is in great favour with millers. It will be raised at 14 centres under the personal supervision of the Agricultural Instructors with the object of raising a stock of selected seed. Till then no seed will be available for distribution.

Specimens of *Peaches* from grafted Australian plants imported in 1916, were received in March from MR. K. B. BEDDEWELA. The grafts were planted at Kumbalgamuwa (Walapane) on October 28th, 1916, and fruited for the first time this year.

Fruits of the *Kali* and *Burdwan Brinjals* (referred to in last Progress Report) were received from MR. NUGAWELA, Agricultural Instructor, raised at Dandegamuwa. The plants flowered within two months and produced large oblong fruit. The *Kali* is dark purple, the *Burdwan* white in colour. There are two varieties of each, one thornless and the other thorny.

The Secretary during his recent stay in Mysore, noticed a variety of dhall (*Cajanus Indicus*) and secured 76 lb. of seed for sale to members. This is known as Garden Dhall as distinct from Field Dhall. The seeds of the new variety in the green state are a good substitute for Peas. The pod is larger than that of ordinary dhall.

PESTS AND DISEASES.

MR. GEORGE CROZIER of Pannipitiya reported the total loss of his mango crop as the result of a disease attacking the fruits about the time they begin to mature. The Government Mycologist examined specimens and reported that the disease was apparently due to *Glœcosporium Mangæ*.

Specimens of orange canker from Mr. BANDARANAYAKE'S Estate at Dedduwa has also been under investigation by the Government Botanist and Mycologist.

MR. KAPUWATTE, Agricultural Instructor, Harasbedde, forwarded specimens of caterpillars of *Agrotis ypsilon* attacking Soya bean.

MR. MADANAYAKE, Agricultural Instructor, Galle, submitted specimens of *Nacoleia indicata* attacking (1) Dwarf French Beans, (2) Insects and aphides attacking long beans and (3) *Plutella maculipennis* attacking mustard.

MR. JAYATILLEKE, Agricultural Instructor, Kalutara, submitted specimens of insects attacking recently-introduced brinjals at Bandaragama. The Entomologist reported as follows:—"The specimens are those of a *Phytophagon cocinnellid, Ephilachna*, either *12-Stigma* or *28-punctata*. This insect is common in South India but is seldom a true pest."

MR. JAYATILLEKE also submitted specimens of *Crossotarsus Minax* attacking mango trees at Bandaragama.

DR. MUTTUKUMARU of Bandarawela sent a specimen of a beetle found in a vine bed. This was identified by the Assistant Entomologist as *Oryctes rhinoceros*, the common black coconut beetle.

During part of January and February the Agricultural Instructor of the North-Western Province (MR. NUGAWELA) was on special duty in connection with coconut diseases.

MISCELLANEOUS.

Under the auspices of the *Kandyan Association Co-operative Credit Society* a prize competition was organised among cultivators in the Kandy district. The awards, which included a silver medal and two money prizes offered by this Society, were distributed by the HON'BLE MR. C. S. VAUGHAN, Government Agent, C. P., on April 5th, when a display was made of the produce raised.

With the opening of new *experimental gardens* at Godakawela, Harasbedde and Medagama, the Society has now 12 under its supervision. The following is a complete list:—

Ambalantota, Balangoda, Bandaragama, Godakawela, Harasbedde. Hettipola, Kegalle, Medagama, Mediwaka, Tanniuttu, Weligama, Weragoda,

With a view to giving every possible encouragement to *bee-keeping* as a home industry, the Secretary has issued a circular advocating the formation of a Bee-keeping Association and calling for a meeting of those interested in the fostering of bee-keeping to consider various questions of importance.

Owing to difficulty in procuring freight, the three *hand-power rice-hullers* ordered from India some months ago have only just come to hand. These machines are to be sent to the larger rice-growing areas with a view to demonstrating their working, and ultimate sale. Already applications have been received for 3 hullers, one from Pesalai, another from Kandy and a third from Batticaloa.

C. DRIEBERG,
Secretary, Ceylon Agri. Society.

REPORT OF COMMITTEE OF BOARD OF AGRICULTURE ON SESSIONAL PAPER No. 1 of 1918.

Your Committee has considered in detail the proposals for the Co-ordination of the Agricultural Services as submitted to Government by the Director of Agriculture. It has held two meetings and would submit the following recommendations for the consideration of the Board of Agriculture:—

1. The proposals outlined appear to have been drafted in such a way as to meet the needs and requirements of the agriculturists of the Colony, and should receive the support of all members of the Board. Provision has been suggested for the separation of the Colony into six agricultural divisions. After consideration of detailed explanations from the Director of Agriculture, your Committee recommends that this proposed arrangement should be adhered to, but suggests that it may be found feasible to begin with only three divisional agricultural officers at the outset.

2. The proposals for the establishment of Provincial Agricultural Schools have much to recommend them and are supported by your Committee, but it is desired to emphasize that in addition to these provincial schools of an elementary character, adequate provision should also be made at the Headquarters of the Agricultural Department for higher training in the sciences of Agriculture. Your Committee believes that the sciences underlying agriculture should be included in the curricula of the Colleges of the Colony, and recognises that the most pressing need is for trained men for all branches of the proposed enlarged Department. It urges that early consideration should be given to this question, and desires that the Board of Agriculture should endorse the Resolution passed by the Committee of Agricultural Experiments to the effect that Government should be asked to adopt a scheme of scholarships in connection with the training of suitable local candidates for the more responsible positions in the proposed agricultural services.

3. As it is desired to attract men of the best classes with good educational qualifications to the agricultural services, it is suggested that the salaries for the Farm School Officers, Research Assistants and Assistants to Divisional Officers should be somewhat improved. It is suggested that they should range from Rs. 1,800/- rising to Rs. 3,600/- per annum in place of Rs. 1,320/- rising to Rs. 3,000/- as proposed in the Sessional Paper.

4. The proposed amalgamation of the officers of the Agricultural Society with the staff of the Department of Agriculture is endorsed, but it is thought advisable that steps should be taken to form an Agricultural Association on the lines of the Ceylon Engineering Association, which would hold Conferences either annually, or more frequently, for the general discussion of agricultural topics. The designation of such an Association was considered, and the general feeling of your Committee was that the old title of Ceylon Agricultural Society should be retained for this proposed Association.

5. The work of seed and plant distribution has formed an important duty of the Agricultural Society in the past. This work is appreciated by the agriculturists of the Colony, and when the proposed amalgamation of the

Agricultural Society with the Department of Agriculture takes place this work should be continued and extended by the Department. Similar work is undertaken by Agricultural Departments of other countries, and is very favourably reported upon.

6. The constitution of the proposed Board of Agriculture was considered, and it is suggested that two members of the proposed Agricultural Society who are not members of the Planters' Association or of the Low-country Products Association, should be added.

The task of your Committee has been a delicate one, involving as it does considerable changes in the existing machinery for rendering assistance to village agriculture, and the merging of the work of the present Society into the Agricultural Department, but your Committee is convinced that more rapid progress is likely to be accomplished under direct Government aid and supervision. There is little doubt that much remains to be done for agriculture in the Colony, and your Committee would therefore recommend the Board of Agriculture to urge that early steps should be taken by Government for bringing the proposals under consideration in this report into operation.

Signed F. A. STOCKDALE,
,, P. RAMANATHAN,
,, H. M. FERNANDO,
,, A. SABAPATHY,
,, O. C. TILLEKERATNE,
,, H. L. DE MEL,
,, A. E. RAJAPAKSE,
,, WM. DUNUWILE,
,, W. A. DE SILVA,
,, A. W. BEVEN,
,, C. DRIEBERG (Secretary).

MINUTES OF PROCEEDINGS OF MEETINGS.

FIRST MEETING.

Minutes of a meeting of the Committee appointed by the Board of Agriculture to report on Sessional Paper No. 1 of 1918, Proposals for Co-ordination and Extension of Agricultural Services, held at the Council Chamber, Colombo, on Thursday the 21st March, 1918.

Present:—The Director of Agriculture (in the chair), The Hon'ble DR. H. M. FERNANDO, The Hon'ble MR. O. C. TILLEKERATNE, The Hon'ble MR. A. SABAPATHY, Messrs, A. W. BEVEN, A. E. RAJAPAKSE, H. L. DE MEL, W. A. DE SILVA, DUNUWILE DISSAVA and C. DRIEBERG (Secretary).

The Chairman opened the meeting by explaining the urgent necessity for such a scheme of re-organization and invited helpful criticism.

Mr. W. A. DE SILVA was of opinion that elementary agricultural education, which had not for its object the training of agricultural officers, should be left in the hands of the Department of Education, and that higher agricultural education should be controlled by the Department of Agriculture.

The Chairman explained that in England all education of an agricultural character was now in the hands of the Board of Agriculture. He deprecated

any change, and attributed the success of the School Gardens Scheme to the fact that it was under the direction of agriculturally trained officers.

The Hon'ble DR. H. M. FERNANDO supported the view of the Director which met with general approval.

DR. FERNANDO thought the scale of remuneration for the men who were to be in charge of the Farm Schools not sufficiently liberal. He was of opinion that the salary of these men as well as the Research Assistants and Asst. Divisional Officers should be on the same basis, and that their appointments should be interchangeable. He suggested a salary of Rs. 1800/- rising to Rs. 3600/- so as to attract good men. The suggestion was generally approved.

In reply to enquiries as to the provision to be made for the training of subordinate officers, the Director stated that he proposed for the present to select the best men from the Agricultural School and give them a 2 years' training in laboratory work under the scientific experts of the Department, in order that they may specialise in Chemistry, Botany (including Mycology) and Entomology. Ultimately a College course of agriculture will have to be provided to form part of the University Scheme.

The Committee were of opinion that the necessary laboratories for students should be taken in hand without delay, and that a chemical laboratory should be provided at once.

The Committee approved of the amalgamation of the officers of the Society with the staff of the Department of Agriculture and of making the TROPICAL AGRICULTURIST a Government publication. The question whether the Society, without executive duties, should continue was left over for further consideration and that in the meantime the Organising Vice-President and Secretary report on it.

The Committee endorsed the resolution of the Committee of Agricultural Experiments to the effect that it is desirable that Government should inaugurate a scheme for the provision of a system of Scholarships in connection with the training of suitable individuals to fill appointments in the higher grades of Agricultural Research.

DR. FERNANDO was of opinion that 3 Divisional Officers should be appointed at the commencement but agreed to the 6 divisions suggested by the Director of Agriculture, and the ultimate appointment of 6 officers to take charge of them.

Resolved that another meeting be held for the day before or after the next meeting of the Legislative Council.

(Confirmed at Meeting of 11th April, 1918.)

SECOND MEETING.

Minutes of 2nd Meeting of the Committee appointed by the Ceylon Agricultural Society to report on Sessional Paper No. 1 of 1918—held in Colombo at the Legislative Council Chamber on Thursday, the 11th April, 1918, at 11-30 A.M.

Present.—The Director of Agriculture (in the chair), The HON'BLE DR. H. M. FERNANDO, The HON'BLE MR. O. C. TILLEKERATNE, MESSRS. W. A. DE SILVA, A. W. BEVEN, A. E. RAJAPAKSE, and C. DRIEBERG (Secretary).

The minutes of the previous meeting held on 21st March, 1918, were duly confirmed.

MR. TILLEKERATNE was of opinion that the provincial schools of agriculture would not find favour as prospective candidates would prefer to attend the Central School at Peradeniya. The Chairman explained that Provincial Schools with farms attached to them were essential in view of the fact that the agricultural conditions differed in different parts of the Island. Students from these schools could join the Central School at Peradeniya for an advanced course of study.

DR. H. M. FERNANDO thought that an early start should be made with a school in one of the Sinhalese provinces, either the Western or Southern.

In connection with the question of qualification for admission into the Peradeniya School, the Secretary was requested to place himself in communication with the Registrar of the Ceylon Medical College and ascertain the conditions governing the admission of students into the College.

The suggestions of MR. G. W. STURGESS, Government Veterinary Surgeon were considered but did not meet with general support.

The future status of the Ceylon Agricultural Society was next discussed and it was resolved that (1) the Society be placed on a similar footing to that of the Ceylon Engineering Association, (2) members of Ceylon Planters' Association and Low-country Products Association be *ipso facto* members of the Society—these Associations making a contribution to cover the cost of the TROPICAL AGRICULTURIST to be supplied to members at cost price, (3) anyone not belonging to either of the planting bodies referred to may join the Society on payment of an annual subscription of Rs. 10/-, (4) the proceedings of the Planting Associations to be published in the TROPICAL AGRICULTURIST if desired by such bodies, (5) Conferences similar to those held by the Ceylon Engineering Association be arranged.

Some discussions followed as to the designation of the proposed Agricultural Association or Society and it was decided to retain the original name.

Resolved that the constitution of the Board of Agriculture should include :—10 members of the proposed Society, 4 of whom to be members of the Ceylon Planters' Association, 4 of the Low-Country Products Association, and 2 others.

On the suggestion of the HON'BLE DR. FERNANDO the name of the Secretary was added.

Sgd. F. A STOCKDALE,
(*Chairman*).

REPORT OF COMMITTEE ON AGRI-HORTICULTURAL SHOWS.

Your Committee has held two meetings and the annexed general rules for arranging catalogue and for preparing, forwarding and arranging exhibits have been drawn up for adoption by the Board of Agriculture and for the guidance of all Agricultural Show Committees.

The question of drawing up definite systems of scales of points alluded to in paragraph 33 was carefully considered and it was decided that no hard-and-fast rules could be laid down.

It is proposed that details of judging by points should be dealt with in pamphlet form for publication and distribution by the Agricultural Society.

(Signed) F. A. STOCKDALE,
H. F. MACMILLAN,
W. A. DE SILVA,
C. DRIEBERG, (*Secretary*).

RULES FOR CONDUCTING AGRI-HORTICULTURAL SHOWS.

General rules for arranging catalogue, also for preparing, forwarding, and arranging exhibits, and for judging.

1. ARRANGEMENT OF CATALOGUE.

1. The catalogue or prize list should be drafted, or at least passed by a person of experience, and then submitted to the Executive Committee for approval, alterations or additions.

2. It should be arranged in classes and groups, the former being numbered consecutively at the top in Roman numerals, and the groups numbered in sequence in ordinary figures at the left-hand margin, thus:—

CLASS 1.

Group	Description	1st prize	2nd prize
1	Palms, six different species ...	Rs. 10/-	Rs. 5/-
2	Anthuriums, best specimen ...	„ 5/-	—
etc.	etc.	etc.	etc.

Indefinite terms, as sub-class, division and sub-division, should be avoided.

3. Any particular conditions affecting a class should be stated at the heading of such a class; special conditions regarding a *group* may be stated in the description, or given as a foot-note.

4. Prizes should not be offered for flowers or crops which are not likely to be in season at the time of the Show, for this only limits the prizes which would be available for other groups or may possibly result in bringing forward inferior specimens.

5. Discretion is specially required in the quantities or numbers specified for an exhibit. These should be just sufficient to be representative and no more, unless with a special object in view. A flagrant example of the transgression of this rule is what is often seen in Ceylon show catalogues as, "Best collection of varieties of paddy." (See para. 17).

6. Descriptions of groups should be definite and incapable of misinterpretation. For instance "species" should not be referred to when "variety" is meant, or *vice versa*. Ambiguous terms should be avoided—for example "Lilies," which cannot precisely be defined, for it may comprise plants of Amaryllideæ, Liliaceæ, Irideæ, Aroideæ, etc. This is a frequent cause of complaint at shows.

7. A distinction should be made when practicable between market gardeners or nurserymen, and amateurs—the former being debarred from competing in the same class. There should, however, if possible, be special prizes for market gardeners and nurserymen, also for School Gardens.

8. The prize cards and rosettes should be of uniform sizes and colours, according to their respective value, for all classes in the Show. Thus the first-prize cards should be red, the second-prize blue and the third or "Highly Commended" lavender or yellow.

9. It is important that the staging provided for the Cut-flower Class, or other exhibits in vases or other vessels be sufficiently firm and level to hold articles in vessels, such as flowers in vases. Flimsy and uneven staging of wattle-sticks is extremely unsatisfactory for such, and not conducive to effective display.

10. Definite positions and spaces should be allotted for the different classes, and these prominently labelled, before the exhibits are received. The managing committee should see that the allotted spaces are in charge of persons who will see that the exhibits are placed in their respective places.

11. Fruits or other exhibits which have an objectionable odour, such as durian and jak, especially when cut open for judging, should not be placed among the more attractive exhibits, but confined to an isolated corner or shed.

12. The managing committee should aim at arranging the classes as nearly as possible in the order in which they are given in the catalogue.

PREPARING, FORWARDING AND ARRANGING EXHIBITS.

13. Intending exhibitors should sow or plant crops of vegetables, flowers, etc., in time (weather and season permitting) to allow these to mature and be at their best at the date of the Show. The period required in each case will vary somewhat according to locality, climate and soil. One is best guided by experience in this respect.

14. Should the specimens ripen a little too early or a little late, a resourceful cultivator can in many cases have recourse to certain measures which will to some extent retard or hasten the process, such as protecting artificially from excessive rain or sun, checking growth by making a cut in the stem as with lettuce, cabbage, cauliflower, etc., or hastening it with applications of liquid or artificial manure, etc. Flowers may be kept back by nipping the earlier blooms, or they may be hastened by protection from rain by means of a sheet of glass held over them.

15. Greater size and perfection may be induced in flowers or fruit by a judicious thinning out, always retaining the best formed bunches or individuals. Sufficient growing space is essential for any crop, whether fruit, flowers or vegetables in order to attain the best size or quality.

16. In selecting exhibits adhere to the rules laid down in the catalogue, more especially in regard to the number or quantity required ; it should be remembered that disregard of these particulars may disqualify an exhibit, however perfect it may be in other respects. Rules are made to be observed and as a necessary basis for the judging of exhibits.

17. Exhibits of produce which have not been grown by the exhibitor or his employer for at least two months before the Show should be disqualified unless stated to the contrary in the catalogue. This need not necessarily apply to flowers for table decoration. The common practice of purchasing produce from cultivators and exhibiting it in the purchaser's name in a competition for prizes should be discouraged.

18. Before sending to the Show, wash root-crops carefully and cut off all unnecessary roots and tops. Support the stems of flowering plants in pots, but avoid obtrusive stakes or ties, which should as far as possible be invisible. Do not use pots that are too large or out of proportion to the size of the plants, and see that they are scrubbed clean.

19. Remember that quality counts for more than quantity—that vegetables, fruits and other edible products should be in their best state for consumption when exhibited. Overgrown vegetables as often exhibited in this country—especially yams, bandakka and sweet-potato—are generally unfit for eating. Fruit should be just ripe; if unripe or overripe it is unfit for judging.

20. Solitary flowers, such as Roses, Hibiscus, etc., for exhibition should, after they are cut, be kept intact by tying a soft piece of wool or cotton around each. This of course must be removed by the exhibitor before the judging commences. Cutflowers of any kind should have their stalks placed in water immediately after cutting ; these will keep longer if, when being trimmed, their stalks are cut under the water instead of in the air.

21. An important point is that the exhibit as a whole should present a uniform appearance or quality—i. e. it should be a "good sample" as it is called in the trade.

22. In transporting delicate fruits such as mangos, papaws, tomatos, sapodillas, oranges, mangosteens, etc., they should be wrapped in paper and packed with fine shavings, sawdust or some soft material to prevent them from being bruised. Smaller fruits, as uguressa, strawberries, purple guava, etc., may be packed in layers with a large leaf between each layer. Large fruits, as plantains, pineapples, durians, jak, etc. should be packed with dry straw or shavings in crates or well-ventilated boxes.

23. Plants, if sent over a long journey, should be packed in crates, the stems, flowers or leaves being securely tied and held in position. Flowering plants in bloom should have each flowering stem staked separately. Pots or tubs should be well wrapped in straw or shavings, and bound round so as to prevent the soil from being shaken or tipped out. (See end of para. 5)

24. Lids of wooden cases should be screwed down (not nailed), or better still hinged and locked with a padlock. Packages sent by rail or other public conveyance should be addressed clearly and marked URGENT; when closed, the top should be marked THIS SIDE UP, and FRAGILE when containing glass or breakables.

25. Fruits, vegetables, herbs, etc., should be shown in shallow basket-trays or plates of uniform sizes. Fruits, especially small kinds of grapes, strawberries, guavas, etc., are rendered more effective by having a few of their own leaves arranged neatly around them. Parsley or similar foliage, as Panax, affords an excellent material for decorating and displaying exhibits to advantage

26. Do not stage small articles in large and unsightly receptacles such as ordinary cadjan baskets, in which the contents are hidden at the bottom. In England regulation dishes or plates are sometimes lent on the Show Ground by the Committee at a small charge.

27. Exhibitors should be careful not to overcrowd their exhibits, especially in regard to plants and flowers, as these often lose in general effect through disregard of this rule.

28. The educational value of an exhibit will be much enhanced if a label is fixed to it, giving the name under which it is commonly known: also, if possible, the botanical name. This will secure points in the judging and add to the general interest of the Show; it is one of the most important considerations at Shows in England.

29. Flowers which naturally grow in clusters as Verbena, Phlox, Schizanthus, etc., are best shown in bunches, while blooms of a large size and distinctive form, as Dahlias, Roses, Hibiscus, etc., are seen to best advantage when displayed singly.

30. Though bottles or tins, if of uniform size and securely held in position, may answer the purpose of displaying cut-flowers, the proper article to use so as to show these to the best effect, as well as to facilitate arrangement, is an *exhibition box*. This may be made of any light wood with a sloping top on the principle of a writing desk, and painted green.

JUDGING AT SHOWS.

31. Persons selected to act as judges should be efficient, possess a practical knowledge of the classes they are to judge, not only of the crops as they appear on the market, but also and preferably through their cultivation.

32. It is usually advisable, especially where exhibits are fairly extensive and competition is close, to appoint three judges to form a quorum, for one or more classes.

33. The system of judging by points, that is awarding a certain number of marks out of a possible maximum to different points of merit, should be adopted whenever there is close contest. The possible maximum may be agreed upon according to circumstances and the number of qualities considered desirable. Thus fruits and vegetables might have the following points:—edible quality, shape, uniformity and size; while with flowers size, colour and form would be the principal points of merit.

34. The judging should always be done as punctually as possible and, needless to remark, before the public are admitted to the Show. Frequently the judges have too much to do in the allotted time, which must result in their work being unduly hurried, or its being delayed until it has to be carried out in the presence of the public, which is very unsatisfactory.

35. Each set of judges should be provided with an interleaved copy of the catalogue, the interleaf being ruled to correspond with the printed prize-list opposite. One judge should write down the winners, while another writes the award card, which should be fixed to the exhibit at the time the award is made. The judges' catalogues containing the written lists of awards should be handed in to the Secretary personally, when they should at once be placed in a secure place.

COMMITTEE OF AGRICULTURAL EXPERIMENTS.

MEETING OF MAY 9, 1918.

Minutes of a Meeting of the Committee of Agricultural Experiments held at the Peradeniya Experiment Station on May 9, 1918.

Present :—The Director of Agriculture (Chairman), the Botanist and Mycologist ; the Superintendent, Botanic Gardens; the Acting Entomologist, the Government Chemist, MR. N. K. JARDINE (Special Entomologist), MUDALIYAR A. E. DE S. RAJAPAKSE, SIR SOLOMON DIAS BANDARANAIKA, MESSRS. A. W. BEVEN, E. W. KEITH, N. G. CAMPBELL, LT.-COL. W. G. B. DICKSON, J B. COLES, H. D. GARRICK, R. G. COOMBE, G. H. MASEFIELD, A. J. AUSTIN DICKSON, and H. A. DEUTROM, Acting Secretary.

The proceedings of the previous meeting held on 7th March were taken as read and confirmed. Before passing on to the Progress Reports the Chairman stated that intimations had been received from MESSRS. M. L. WILKINS, G. H. GOLLEDGE and J. S. PATTERSON regretting their inability to be present.

(2) *Progress Reports.* The Chairman stated that the vanilla crop of Peradeniya for 1917 was a good one, and that the vines were flowering freely now. The crop had not yet been sold, as no satisfactory offers had been received. He also made reference to the low yield in the Cacao crop for the year 1917-18, and to the paddy experiments carried out at Peradeniya. Judging from the results, he was of opinion that the low country varieties were not suitable for this elevation. The Philippine varieties had done well at Anuradhapura. Records of experiments carried out at the Dry Zone Station would, he added, be available at the next meeting. MR. MASEFIELD enquired whether any hill paddy introduced from India had been tried at Peradeniya, to which the Chairman replied in the negative. The Chairman undertook to make enquiries *re* suitable varieties.

(3) The Government Chemist referred to the summary of results of the cacao manurial experiments that had been tabled.

MR. MASEFIELD enquired if any deductions were made for vacancies in the plots, and was informed that no such calculations were made. The Chairman stated that the natural yield of the plots should have been ascertained before the manurial experiments were started.

(4) *Tobacco Samples.* Referring to the correspondence tabled, the Chairman stated that the report was encouraging and would be reproduced for general information. White Burley was considered the only variety suitable for Jaffna. MESSRS. JUL. SIEMSSEN & CO. of London had offered to purchase the three thousand pounds of tobacco available from the 1918 crop at 1*s.* 9*d.* to 1*s.* 10*d.* per pound, delivered in London. The offer was considered satisfactory, and it was proposed to accept it after reference had been made to the Jaffna Tobacco Committee.

The Chairman announced that MR. WILSON from South Africa had been appointed to succeed MR. SCHERFFIUS, and that he was expected to be in the Island early in November. Experiments would be carried out at Jaffna and at Teldeniya.

MR. BEVEN enquired as to why experiments with good cigar tobaccos had not been successful at Jaffna, and the Chairman stated that all the cigar tobaccos at Jaffna contained an excess of chlorine which affected the flavour and burning qualities.

(5) *Shot-hole Borer.*—MR. SPEYER referred to the progress report circularised to members. A new list of estates infected with shot-hole borer had been prepared, the estates being arranged under their districts, instead of their provinces, with the object of enabling planters to make choice of uninfected district or districts, where only a few estates were infected when purchasing tea-plants. The list is preceded by a history of the insect in Ceylon and its external distribution. From correspondence there is no doubt that the borer existed on the Craighead estate, Nuwalapitiya, in 1892 and was then well-established there and on some four estates round Peradeniya.

Life History. The notes on the life history were given in the report and observations upon the fungus upon which the larvæ feed have led to the conclusion that lines of control by attempting to control that fungus would not be practicable.

Burying of Prunings. An experiment with 16 lots of prunings had been carried out, these being buried to a depth of 2-5 inches. A practically continuous drought was experienced and an average of 4 beetles emerged from each lot of prunings during a period of 57 days. These being all females, and probably fertile, it is certain that the wholesale burying of prunings in dry weather cannot be recommended with a view to controlling the pest. In a good number of cases, galleries of the insect were found healed over by an ingrowth of cambial tissue in the buried prunings at the end of the experiment, and more of them were found in the prunings buried with powdered calcium phosphate and with slaked lime, than those buried with ammonium sulphate, quicklime, or without a manurial ingredient. An average of only 1 beetle emerged from the calcium phosphate and slaked lime lots, whereas averages of 6 and 4 emerged respectively from the quicklime and ammonium sulphate lots.

The number of branches buried in each hole represented only about $\frac{1}{4}$ of the number included in each hole under estate conditions.

MR. MASEFIELD remarked that the experiment did not throw any further light upon the question as to whether prunings should be buried or not. He suggested that heat generated in the holes would be much greater where prunings were buried under estate conditions. MR. SPEYER gave figures of MR. RUTHERFORD'S and his own, to show that the borer, in prunings actually buried on estates, was not affected in either wet or dry weather by the generation of heat.

MR. BAMBER suggested that the generation of carbon dioxide might kill the beetle. MR. SPEYER said that sulphur dioxide had no effect on the insects and hydrogen cyanide had but slow effect. The fact that beetles develop normally for a period of at least 3 weeks in prunings buried on estates show that the gases generated in that period have no effect on the beetles.

The Chairman pointed out that MR. SPEYER'S experiment showed that the burying of prunings in dry seasons had nothing to recommend it from the point of view of shot-hole borer. Prunings left on the ground unburied in

dry periods were not likely to be responsible for any more shot-hole borer emerging than those which were buried. In wet periods, however, it still had to be determined which was the safest method, as MR. SPEYER had shown that beetles were able to emerge in wet weather from unburied prunings for a period of 3 weeks.

Paint for Tea Bushes after Pruning. An emulsion of *fish-oil* with soap and rosin had given a good result when applied to bushes after pruning. Many parent beetles had been killed, but an increase in the proportion of oil would give better results still. Concentrated mixtures in which a partially satisfactory result had been obtained produced no retardation in the output of new shoots. The mixtures with a higher percentage of oil were now being applied, with great likelihood of complete success. This mixture could also be used as a spray in a less concentrated form.

The Chairman remarked that MR. SPEYER's experiments had shown that *coconut oil* could not be used in any form owing to its deleterious effect upon the bushes treated. When a suitable fish-oil mixture had been determined upon, it was suggested that this should be used in an experiment on an estate scale.

Castor Oil Tree. Four varieties had been planted from seedlings in tea for the purpose of establishing a trap crop if possible, but it was found difficult to establish seedlings. Experiments would be tried with seed.

The Chairman remarked that such experiments with castor as a trap would be useful, but the nature of the attack by borer in that tree would entail the most rigorous supervision if the results were to be in any way beneficial.

(6) *Permits for removal of Tea Stumps.* The Chairman stated that in accordance with a resolution of that Committee, regulations had been framed whereby no tea stumps were to be removed from one estate to another after the 1st January 1918 without a permit from the Director of Agriculture. A period of 4 months had been allowed for estates to become conversant with these new regulations. This period had now elapsed, and the Police and the Railway Authorities had been given definite instructions to control all movements of tea stumps and to report any cases where movement without permits was being attempted. This matter was specially brought up, as the planting season was on, and it was desirable that the regulations should be generally known. After discussion on various points connected with the issue of permits it was suggested that the Railway Authorities be asked to allow permits for tea stumps conveyed by rail to be attached to the way bill.

(7) *Tea Tortrix investigations.*—MR. N. K. JARDINE stated that he would have liked to have spoken on such points as the History of the insect, Geographical distribution, Distribution in Ceylon, Climate influence, and possible preventive and remedial measures, but he confined himself solely to a very brief outline of the Life History, the reason of the sudden appearance of the insect in previously unattacked tea, and a few figures on the loss of crops sustained by Tortrix.

MR. JARDINE expressed his thanks and gratitude to the Planting Community, particularly those gentlemen who had undertaken the up-country experiments, for their assistance had so greatly aided the Tortrix Investigation that its progress has been hastened with accuracy, allowing him to produce his first report at an earlier date than could have been without assistance.

MR. JARDINE mentioned that in his opinion there was an agent—other than insect parasites—responsible for the control, and, accounting for, the three year cycles, of tortrix ; namely, wilt—an ultramicroscopic disease which killed the insects in great numbers. There is in every colony or brood of the pest certain individuals immune to wilt which carry on the species. To-day we have little of the pest—practically only immune individuals. Wilt lacking an adequate number of susceptibles becomes latent. The immune individuals now propagate. In the second year Tortrix is abundant and susceptibles appear in the colonies ; the latent disease has now individuals to work upon. In the third year the pest is prolific and the percentage of susceptibles greatly increased—possibly due to a weakened state of the colonies by overcrowding and lack of food material. Wilt sweeps through the colonies and in the fourth year Tortrix is reduced, only immunes remaining to carry on the species.

MR. JARDINE stated that he intended to study closely this disease and endeavour to use it as a control of the insect.

(8) *Treatment of Brown Bast Disease.* MR. R. G. COOMBE referred to the different treatments which had been proposed for Brown Bast in other countries and asked which was recommended by the Mycologist. The Mycologist stated that he recommended scraping, as practised for ordinary canker, and the subsequent application of strong Brunolinum. Where the diseased bark had formed a dead scale, the scale should be removed and the underlying thin layer of cortex treated with Brunolinum without scraping. It was decided to issue to the Press a communique on the experiments that have recently been carried out on preventatives against bark diseases and to draw up the full results for publication in leaflet form.

(9) *An experiment to determine how long the young coconut plant is dependent upon the kernel and the coconut water.*—MUDALIYAR RAJAPAKSE stated that the experiment was started on the 15th of June, 1916, and concluded on the 15th of February, 1918.

20 selected nuts were placed in a line with tops up, on a stand, about 8 feet high in the open.

The nuts were weighed separately and numbered and the weighing was repeated once in every two weeks till the end.

The weights, the dates of germination, and deaths were carefully recorded. No attention was paid to the nuts.

3 nuts germinated in	3	months	& 15	days.	2 plants died in	8	months	& 15 days.
3 „	„ 4	„			1 plant	„ 9	„	
3 „	„ 4	„	& 15	„	2 plants	„ 12	„	
2 „	„ 5	„			1 plant	„ 14	„	
1 „	„ 5	„	& 15	„	1 „	„ 15	„	
1 „	„ 6	„			3 plants	„ 15	„	& 15 days,
1 „	„ 7	„			3 „	„ 16	„	
2 „	„ 8	„			3 „	„ 16	„	& 15 days.

Four nuts Nos. 1, 3, 4, and 5 failed to germinate. The average time taken to germinate was 5 months.

The rainfall of every two weeks was separately recorded to show how the weight of the plants varied with the weather.

On SIR S. D. BANDARANAIKE'S enquiry whether the nuts came from the same field, MUDALIYAR RAJAPAKSE replied in the affirmative and stated they were not, however, from the same tree. SIR SOLOMON commented on the position of the nut in planting, and MR. BEVEN stated that placing the nut on the side was, in his opinion, the best.

(10) *Bud Rot of Coconuts.* The Chairman brought up this subject for the opinion of the Committee as to whether this disease should be added to the proclaimed list of coconut diseases. It was stated that the disease was of an infectious nature and there had recently been cases in the Kalutara district. After discussion it was resolved that this disease should be added to the schedule.

(11) The Chairman announced that the Indents Committee had brought to his notice that the Government of India had prohibited the export of castor oil, and suggested raising crops in Ceylon in the Low Country to meet the local demand.

After discussion the following resolution proposed by MR. MASEFIELD was unanimously carried :

"That this Committee has considered the question of the possibility of growing castor oil at the present time, and urge upon Government to encourage its cultivation outside the tea growing area and to provide a purchase scheme for the produce grown."

The meeting then terminated with the usual vote of thanks to the chair.

H. A. DEUTROM,
Ag. Secretary,
Committee of Agricultural Experiments.

Peradeniya, 15th May, 1918.

PROGRESS REPORT PERADENIYA EXPERIMENT STATION.

FROM 1ST FEBRUARY TO 30TH APRIL, 1918.

TEA.

The yield for the month of February was 1,373 lb. green leaf, for March 1,758 lb. and for April 2,903 lb. from 11 acres. The November-December and January-February made tea fetched in Colombo 38 Cents and 45 Cents per lb. respectively, for all grades.

The Dadaps in Plots 144 and 149 have been cut and mulched after an interval of five months, yielding 2,740 lb. and 2,305 lb. green mulch respectively.

All the drains through the tea have been thoroughly cleaned out.

Mustard has been sown in the bad patch of cora grass in plot 155 after the bulbs had been dug out.

Plots 146-150 were tipped in April, the live branches being cut off at the same time.

Owing to the severe drought in February and March a large number of the Huldubari Dooars stumps in the newly planted two acres which have been nursed with so much trouble, have died out. Steps have been taken to procure stumps to fill up vacancies in favourable weather.

The interplanted sword bean has grown well, and is bearing a heavy crop of large beans.

The jungle between the new plots of tea and Hill-top rubber has been cleared. The work of removing the balance timber, etc., will be completed by the end of May.

RUBBER.

Holes have been dug in the young plantation and cattle manure put in for planting the vacancies as soon as the rains set in.

Leucæna glauca in the avenue rubber 15 ft. × 15 ft., and space of 40 ft., was pruned and the loppings mulched in rows between trees after forking, 4,300 lb. of green material having been obtained from a single cutting in the space of 350 ft. × 30 ft.

Plot 81, row B which was previously tapped at 1/3rd 2 cuts at 2 feet apart three times a week, having being completed, a new section has been started.

Applications of Brunolinum to the newly tapped surfaces have been stopped since February until the monsoon commences.

A tree in plot 153 which was found to be affected with *Fomes semitostus* was uprooted, all lateral roots being traced and removed. A trench 2 ft. × 2 ft. was dug round the affected area which was limed. All fallen leaves round the tree have also been collected and burnt.

All dead branches of rubber trees are being cut out and burnt.

Plots 83 A, B, D, 84 A, C, D, 85 D, and 86 A, were manured with the various mixtures. Plot 86 B, C, (mineral) was not manured, as it has been decided to take off some of the trees and straighten the rows. The manures were applied in a central trench, 6 inches deep and 3 feet wide instead of 2 feet. The fallen leaves were swept into the trench and lightly forked in.

The two acre plot planted in avenues 40 ft. × 15 ft. × 15 ft. was manured according to the scheme. Lime was not applied this year.

Leucæna glauca planted in May 1916 between the avenues in the limed plots was uprooted.

The *Cajanus indicus* planted in plots 11, 12, and 13 show very luxuriant growth and are flowering profusely.

CACAO.

All the cacao plots have been thoroughly pruned and cut back. A round of removing superfluous suckers is in progress.

The trees are in heavy blossom, and promise a fair spring crop.

A small round of picking was done.

Series I, II and III (Old Cacao) and 4 acres of 10-year old cacao "B" were manured according to the scheme, lime having been applied this year.

A further consignment of 100 bags cacao has been despatched for sale to MESSRS. KEELL & WALDOCK, Colombo, and fetched Rs. 43·00 per cwt.

The paths between the plots have been cleaned.

COCONUTS.

The 10 acre plot of coconuts has been thoroughly weeded and the drains cleared. The flat land has been ploughed.

Manuring of the different plots is in progress.

There has been a slight improvement in the price paid for coconuts at the last auction held in March, Rs. 21·50 per 1,000 have been obtained.

COFFEE.

The dadap and Leucæna shade over the coffee has been pruned and mulched round the plants.

All suckers have been regularly removed.

The plot of Ceara rubber, 1 acre in extent, adjoining the Robusta plot has been cleared and lined 10 feet by 10 feet for planting coffee.

The dadaps in the old papaw plot behind the Stores planted as shade for coffee, have been cut down to 5 feet.

The different strains of coffee from Java planted in bamboo pots will be ready for planting out with the first rains.

The Robusta and Hybrid varieties have been sprayed for green bug and leaf fungus.

The crop of Robusta is now over and seed will not be available until October next.

PADDY.

The different varieties of paddy sown in August have all been harvested. It is obvious from the results that many of the varieties are not suited to the district. The results are appended.

It has been decided not to sow a Yala crop this year; the fields were therefore ploughed and left for a month to weather, and then sown with *Crotalaria juncea* (sunn hemp).

VANILLA.

The vines flowered very freely in March and April, and the flowers were hand-fertilized.

The crop in 1917 was an exceptionally good one. Over 1 cwt. of cured beans was obtained from half an acre, an increase of over ½ cwt. above the previous year's crop.

FOOD PRODUCTS AND CURRY-STUFFS.

The following food products and curry-stuffs have been harvested :—

Cow peas, French beans, coriander, cummin, fenugreek, and mustard. The yields of this crop were not satisfactory owing to the prolonged drought which had been experienced. Seeds have been carefully stored for resowing with the first rains.

Seeds of a garden variety of dhall have been planted out in the young rubber plots.

GENERAL.

The green manure plots round the office are making fine growth.

Quarter acre of sweet potatos has been established. Weights of crop will be recorded.

The belt of jungle above the tea plots has been cleared up to the old abandoned road.

Since the leaflet on *Leucæna glauca* was issued, orders for 175 lb. of seed have been received, and are being executed.

VISITORS.

73 visitors have been conducted round the station since my last report.

RAINFALL.

	Inches.	Rainy days.
February	—	—
March	3·96	5
April	4·04	10

H. A. DEUTROM,
AG. MANAGER, E. S. P.

RESULTS OF PADDY EXPERIMENTS.

Name of Variety.	Date of Sowing.	Date of Trans-planting.	Date of Flowering.	Date of harvest-ing.	Yield calculated to the acre.
Muthu Samba	3-9-17	10-10-17	9- 1-18	27-3-18	20 bushels.
Molagu Samba	20-8-17	8-10-17	23-12-17	12-2-18	30 ,,
Swarnawari	29-8-17	11-10-17	25-10-17	15-12-17	½ ,,
Mada-el	29-8-17	13-10-17	15-11-17	11-2-18	15 ,,
Philippine	28-8-17	15-10-17	14- 1-18	9-3-18	20 ,,
Mulan-ay-manilla	28-8-17	15-10-17	24-11-17	28-2-18	15 ,,
Kahara-mana	28-8-17	16-10-17	23-12-17	1-3-18	10 ,,
Ein-el-hint	29-8-17	17-10-17	5-12-17	2-3-18	32 ,,
Fino	29-8-17	16-10-17	18-12-17	1-3-18	5 ,,
Macan-pina-manilla	29-8-17.	15-10-17	5-12-17	12-2-18	12 ,,
Dr. Lock's Hatial		9-10-17	15-12-17	9-3-18	31 ,,
Handiram		13-10-17	24-11-17	21-1-18	10 ,,
Hatial (village)		11-10-17	9- 1-18	19-3-18	48 ,,
Sadai Samba		10-10-17	5- 1-18	8-3-18	30 ,,

PROGRESS REPORT OF THE EXPERIMENT STATIONS, ANURADHAPURA AND MAHA-ILUPPALAMA.

FROM 1ST FEBRUARY TO 31ST MARCH, 1918.

ANURADHAPURA.

The acting Manager inspected the Station on three occasions since the last report.

A plot of Mauritius hemp has been planted out 5 ft. × 5 ft. The plants are coming on well.

A portion of the jungle land recently cleared and burnt has been sown with a crop of gingelly.

The channels, drains, and divisions between plots are being cleared and reconstructed.

The following crops have been resown :—Coriander, fenugreek, fennel, aniseed, mustard, chili, maize, kurakkan, dura, *Setaria italica*, cow peas, dhall, ginger, turmeric and castor. The plots of Mauritius sweet potato have been extended.

The different varieties of paddy sown in October have all been harvested. As the crop has not yet been threshed owing to rain, a detailed table of yields will appear in the next report.

Several orders for seed paddy have been received from paddy land owners in the district.

The fields are being ploughed and disc-harrowed for planting chillies.

The following crops are being harvested :—Lima bean, cow pea, grams, coriander, chillies and onions.

The betel vines have been manured and pruned. The plot has been extended and *Sesbania grandiflora* sown to serve as supports.

The dadaps in coffee have been thinned out to 12 ft. apart. The thorny variety has been uprooted, as the trees cannot be conveniently lopped.

Some of the oil palms (*Elæis guineensis*) planted in November, 1915, have flowered and seeded.

The plot of young coconuts near the cooly lines has been ploughed and disc-harrowed.

A portion of the barbed wire fence has been repaired, new jungle posts being used to take the place of the damaged ones.

The Foreman's quarters have been rethatched with cadjans obtained from Maha-illuppalama.

32 visitors were shown round the Station.

MAHA-ILUPPALAMA.

The first crop of coconuts for the year was plucked in March and April, the number of nuts collected being 4,590 from an area of 23½ acres.

In the irrigable area consisting of 1,224 palms, 738 palms gave 4,224 nuts, an average of 5·72 nuts per bearing palm.

In the unirrigable area consisting of 449 palms, 60 palms gave 366 nuts, an average of 6·1 per bearing.

The irrigable plots were flooded twice during each month.

A nursery of 1,000 selected nuts has been laid down.

A consignment of copra from unsound nuts was sent to Colombo and sold, fetching Rs. 33 per candy.

An offer of Rs. 20 per 1,000 good coconuts delivered at Maha-iluppalama has been received and accepted.

The chili plots with the exception of the small plots of the Nagpur and American varieties which were fenced, were completely destroyed by stray cattle.

The Nagpur long and round, and American round varieties have produced fine large specimens of chillies. Seed is being collected for sowing at Anuradhapura and Peradeniya.

The oil engine and cotton ginning machine have been dismantled and brought to Peradeniya.

The cooly lines have all been rethatched.

H. A. DEUTROM,
Ag. Manager, E. S.

NILDANDAHINNA AGRICULTURAL SHOW.

This Agricultural Show was the first held in Walapane. Hitherto exhibits from Walapane, Kotmale and Uda Hewaheta used to be sent to the annual Agri-Horticultural Exhibition at Nuwara Eliya.

The Government School building at Nildandahinna was utilised, but the exhibits were so numerous that the Gansabawa building had also to be requisitioned. The collections of grains and pulses and country vegetables were remarkably large and varied. In fact, I have seldom seen finer collections of grains and pulses. There were 54 exhibits of Kurakkan (*Eleusine coracana*) of 8 varieties, 52 of Thana (*Setaria italica*) of 4 varieties, 31 exhibits of Kollu (*Dolichos biflorus*) in 2 varieties; 13 of Amu (*Paspalum scrobiculatum*; 13 of Menèri (*Panicum miliare*) of 2 varieties; 16 of Thawaliya (*Setaria glauca*); 30 of mustard (*Vigna sp.*); 23 of Pala (*Amaranthus sp.*); 16 of Mun (*Phaseolus radiatus*) of 2 varieties; 34 of Kola mé (*Vigna sp.*) of 3 varieties; 34 of Mé (*Vigna sinensis*) of 5 varieties; 50 exhibits of Indian corn of 4 varieties; 25 of Undu (*Phaseolus max*); 113 of Dambala (*Phaseolus lunatus*) of 11 varieties; 4 of Parippu (*Cajanus indicus*); 8 of Karal-Iringu (*Sorghum vulgare*) and 2 of gram (*Cicer arietinum*). There were 15 collections of grains and pulses of not less than 15 varieties. The prize collection contained 56 varieties. There were also 10 collections of paddy including Goda-el (a variety of Hill Paddy), the largest collection containing 24 varieties; also 4 collections of rice, the best containing 16 varieties.

Curry-stuffs were represented by Coriander, Black Cumin and Asamodagam (*Carum copticum*) grown in the district.

Vegetables.—The show of native vegetables was a credit to Walapane. Exhibits of brinjals, capsicums, beans, tomatos, cucumbers, pumpkins, gourds and jak were remarkably good. There were 8 varieties of brinjals including the large Malda, 20 varieties of chillies and capsicums, 11 varieties of beans, 7 varieties of bitter gourds. There were good collections of kekiri (country cucumber), snake gourd, onion, cho-cho, potatos, luffa and cooking

Photo by John & Co., Kandy.

DEDIGAMA AGRICULTURAL SHOW.

Arrival of Assistant Government Agent.

plantains, okra, mè, granadilla and murunga. Large collections of wild leaves used for food and medicines were exhibited as well as a good collection of yams. English vegetables were represented by a few beets, turnips, cabbages, khol-rabi and carrots.

Fruits.—The fruit section was very fair. There were good mangos and oranges ; a lot of papaws, limes and guavas, very fair pines, peaches, passion fruit, citron, bullock's heart and soursop. The eating plantains exhibited in this section were very good—especially the Suwandel, Embul-horanawala, Kolikuttu and Anawalu.

Economic Products.—This section included very fine coconuts grown in Pannala and Ambanwela, which would have done credit to any low-country estate ; a large number of fine arecanut bunches ; good exhibits of fibres (including cotton); cacao, tobacco and betel ; very fine specimens of turmeric and ginger, and good specimens of sugar cane.

Prepared Products.—These consisted of good samples of coconut and mi (*Bassia longifolia*) oils, ghee, kitul treacle, and fine samples of kitul and sugar-cane jaggery ; also several exhibits of honey in comb and a collection of native medicinal oils.

Industrial Products.—These included very fair pottery, coir and ekel brooms and good models of catties, mamoties, pruning knives, and arecanut cutters. The mats, baskets and boxes shown were not of a high order. A few exhibits of Rodiya manufacture were also on view.

In the Live Stock Section a number of native bulls and cows and buffalos were exhibited. These were not particularly good specimens.

ALEX. PERERA.

DEDIGAMA SHOW.

The fourth of the series of village shows in the Kegalle District was held in Beligal Korale, on the Dedigama Gansabawa grounds, on the 18th and 19th May last. Considering that the show was limited only to exhibits from residents of the Korale the competition was good, and the number of exhibits satisfactory.

A feature of the show was the handsome pavilion of Kandyan design specially erected for the occasion. This was, however, rather too small to hold comfortably all the exhibits which had to be somewhat crowded together.

The classes consisted of Fruits, Vegetables, Tubers, Cereals and Pulses, Curry-stuffs, Miscellaneous Vegetable produce (products of the coconut palm, etc.), School Garden produce, Oils, Manufactured Articles, Sweets and Pickles, Livestock, Needle Work and Lace, Flowers and Pot Plants. All the classes were well filled—vegetables, fruits and tubers, specially so. The show of pineapples was particularly good. Among vegetables, Brinjals were noticeable for both number and quality.

Those who assisted in the judging included MR. F. A. STOCKDALE, Director of Agriculture ; MR. C. DRIEBERG, Secretary, Ceylon Agricultural Society ; MR. N. WICKREMARATNE, Secretary, Board of Control, Co-operative Credit Societies.

The show was opened at 2-30 p.m. by MR. G. F. R. BROWNING, Asst. Govt. Agent, Kegalle ; and among visitors was MR. E. B. DENHAM, Director of Education, and some of the resident planters of the neighbourhood.

The RATEMAHATMAYA, MR. L. B. NUGAWELA, is to be congratulated on the success that attended his efforts.

The large attendance of villagers and school children testified to the keen interest taken in the show by the local residents.

C. DRIEBERG.

LEUCÆNA GLAUCA.

SOME CULTURAL NOTES.

There are 6,330 fresh seeds, or 9,850 sun-dried seed to the pound. The seed should be covered with *boiling* water and allowed to soak for 12 hours before sowing, the water being allowed to cool.

It is best planted seed at stake, 2 or 3 seeds being put in each hole and thinned out when 3 or 4 inches high. These seedlings can be used to supply vacancies elsewhere, but must be transplanted quickly in showery weather. In tea it should be planted in rows 12 or 16 feet apart and 6 or 8 feet apart in the rows, or closer, if wind protection is required.

As a green manure it should be cut across when 4 feet high at 18 inches and the material mulched up the rows and forked in at pruning or when applying manure.

As a hedge for wind it should be cut at 4 feet and the branches utilised in the same way.

In Rubber clearings, it should be sown 3 ft. × 3 ft. between the rows, leaving a clear line 4 feet wide on each side of the rubber or it can be planted 3 ft. × 3 ft. all over, leaving 8 feet diameter rings round the trees clear. It should be cut when 3 to 4 feet high before flowering and mulched in rings 2 to 4 ft. from the tree and gradually extending by pulling out the plants nearest the trees or rows each year.

For fuel purposes, the seed should be sown 5 ft. × 5 ft. and the plants kept clean weeded until the shade is dense.

As shade for Coffee, 2 or 3 seeds should be sown between every 4 coffee trees and thinned to one plant ; as it increases in height side branches should be lopped and the tops cut across twice a year, the green material being mulched round the coffee trees in gradually increasing rings.

As Fodder, it should be planted as hedges, also 3 ft. × 3 ft. and cut as for green manure. If for seed the plants should be cut at 8 or 10 feet and then allowed to flower and seed.

Planted 3 ft. × 3 ft., one pound of seed per acre is sufficient, giving 2 seeds in each hole.

H. A. DEUTROM.

LEUCÆNA GLAUCA IN JAVA.

Mr. A. Egges Post, of Salatiga, Java, writing under date 6th May, 1918, states as follows regarding *Leucæna glauca* :—

With interest I read all what you write about this plant and it is a wonder that it is nearly unknown in Ceylon while in Java already it has been planted for a long period as shade tree in Coffee and Cacao and has replaced other shade trees. For Hevea plantations it is sown in rows on the sides of the terraces and after two years form steady terraces from which the plant every two or three months is cut and used for green manuring. During long droughts the leaves do not fall as is the case with other shade trees.

He also states that he has seeds in considerable quantity for disposal.

ENTOMOLOGY.

PROGRESS REPORT ON INVESTIGATIONS INTO SHOT-HOLE BORER OF TEA.

1. *New list of estates infected with Shot-hole Borer.*

The infected estates have been arranged in alphabetical order under their respective revenue districts irrespective of the provinces in which they lie. The object of this is to enable planters desirous of buying tea plants to select districts where there is either no shot-hole or in which very few infected estates exist thus minimising risks to their own estates.

2. *Further notes on the life-history.*

A female beetle which emerged from buried prunings was induced to make a gallery in a cut tea stem. At the end of 40 days from entry of the beetle, the parent female, a young male, two young females and a female pupa were present. The development at an elevation of 1,600 feet is therefore more rapid by some 3 weeks than that at elevations of 4,300 feet.

Observations on the fungus upon which the larvæ of shot-hole feed, show that 2 fungi are generally present in healthy galleries. These have been identified by Mr. Petch as Monacrosporium and a conidial Ambrosia fungus. The spores of the former appear in the gallery about 7 days after the beetle has entered the branch. It is known that the conidial stage of some Ambrosia fungi are modified stages of fungi which grow free, on certain media in a totally different form ; there is therefore a possibility, though a remote one, that Monacrosporium is the free living phase of the Ambrosia grown by shot-hole borer. Mr. Petch and I both agree that economic control by trying to destroy this fungus in the galleries is impracticable.

3. *Development in buried prunings.*

16 lots of prunings were buried, 8 on the slope and 8 on the level on February 19th and covered with inverted tea-chests with a hole in one side of each fitted with a glass tube.

8 lots were buried to a depth of 2-5 inches.			
2	do	do	with ½ lb. quicklime (stone).
2	do	do	,, ½ ,, slaked lime (powdered)
2	do	do	,, 2 oz. Ammonium sulphate
2	do	do	,, 2 oz. Calcium phosphate (powdered)

Beetles started emerging into the tubes on February 20th and continued to do so until April 16th, a period of 57 days.

From the 8 lots buried without addition of lime or manures 39 beetles emerged,—28 from the slope, 11 from the level.

From the other lots beetles emerged as follows :—

Quicklime	Slope	11	Level	1	Total	12
Slaked lime	,,	0	,,	2	,,	2
Calcium phosphate	,,	1	,,	1	,,	2
Ammonium sulphate	,,	2	,,	7	,,	9
						25

From the figures it may be surmised that an average of 4 beetles emerged from each lot, but that the lots taken separately are subject to error, for, from the lots buried ordinarily, in one case no beetles emerged, and in two only one. From the separate lots the most that emerged was 11, from one of the quicklime lots. These irregularities may in part be due to the fact that white-ants damaged the chests considerably in the later stages of the experiment, and there is a possibility that a good number of beetles escaped under the sides of the chests, even though these were buried level with the bottom of the holes. 32 days after burying, large numbers of insects in all stages were still present in the prunings, but after 56 days only a few adults and one or two eggs were found.

From the condition of the prunings at 56 days, it would appear that a certain number of galleries heal over after being buried, causing in some cases the death of the inmates, and that this healing is increased by calcium phosphate, by slaked lime (powdered) to a lesser extent, but not by unslaked (stone) lime or ammonium sulphate. An almost continuous drought was experienced during this experiment but a certain amount of moisture remained in the prunings until the end. From the previous experiments, it would seem that rain increases the capacity of the wood for healing.

If an average of 4 beetles emerge from each hole in the dry season, only an increase of borer can be looked for by the burial of prunings at that time. It is probable that the beetles were fertile when they emerged, and it is evident that the insect develops normally, up to a certain point, in the buried prunings.

4. *Experiments with paints.*—An emulsion of coconut oil was made with coconut oil soap. The effect on the bushes precludes the use of this oil absolutely, even in the most dilute solutions.

A substitute has been found in fish-oil, which can be emulsified with Ceylon Soap and Rosin. Experiments are proceeding with great likelihood of success, both economically and with a view to killing the borer. It may be possible to substitute liquid fuel for fish-oil, and thus make the mixture still cheaper.

As a preventive measure only, a mixture of Rosin and Ceylon Soap suitably diluted can be recommended, but not as a direct means of killing the insects outright. This mixture is proving of great value as an insecticide for scale insects and aphis, being cheap, easily made, and having less caustic properties than contact poisons generally in use. A soda solution of vegetable tar was ineffective in killing the borer.

5. *Castor-Oil Experiments.*—4 varieties have been planted from seedlings in infested tea. The plants are not easy to establish, and another experiment will be started direct from seed.

E. R. SPEYER.

ADDITIONAL FACTS REGARDING TEA TORTRIX.

The Life-History has been thoroughly ascertained and is as follows :—

The average number of larvæ per egg mass is between 125 and 150, A point of interest is that during November, December, January and February the egg-masses which were sent into the laboratory were very small in comparison to those examined earlier in the year. Only 44% contained over a hundred larvæ ; the great majority numbering less than 70. It was proved that if the female is disturbed while egg-laying she will lay several small masses which, on being totalled, average 125 eggs.

The incubative period of the egg is 10 to 12 days at elevations of 3,000 to 4,500 feet. At Peradeniya it is 7 to 10 days.

The duration of larval life is four to five weeks on the average. There is a great variation of time in this stage of the metamorphosis. I have instances of the larval life being three weeks and six days ; four weeks and one day ; and six weeks and four days. This variation of time of the larval life causes an overlapping of broods.

The pupal period is five to six days in the case of the male, and seven to eight days in the case of the female. Here again variation and conflicting evidence is found. There are instances of the male taking 11, 9, and 8 days in pupation, and the female taking 6, 5 and two instances of 2 days.

The life of the moth depends, in the case of the males, how soon after emergence from the pupa they fertilize, as they die some six hours after fertilisation has taken place. The average life of the male in captivity in an environment approaching the natural element as close as possible is five days.

The life of the female depends upon how soon after fertilisation she lays her eggs. The average life is seven days ; death taking place some twelve hours after egg-laying.

The actual life history of the insect from the laying of the egg to death is six to eight weeks :—

Egg to larva	1 week 3 days
Larva to Pupa	4 to 5 weeks
Pupa to Adult	1 week
Adult to death	1 week

Thirty-two experiments on the life-history have been worked out in the laboratory, the half of this number being control experiments.

Seven up-country experiments have been instituted, and the date derived from them compared with the laboratory results. These experiments range from 4,000 feet to 5,200 feet. The only variation in the life history between the 4,000 altitude and that of Peradeniya is in the egg stage, the incubative period is longer at the higher altitude by one to three days.

In January and February of this year at 4,200 feet the larval period reached seven weeks as against the average of four to five. The temperatures at night during these months in the particular district were exceptionally low, often reaching 50 degrees and on two occasions 44 degrees and one

may safely conclude the temperature was responsible for the delayed development of the larvæ.

I would like to bring up two points of interest regarding tortrix, one being a point which has confused many of us for a long time but which is now solved; and the question of the amount of crop lost through the pest.

TORTRIX ON GREVILLEA, DADAP, ETC.

The first point is the reason of the sudden appearance of the insect in the centre of a field which a few days before was free from it.

Why should three or four solitary bushes right in the field suddenly be attacked, when we know for a fact there were no insects on those bushes a week before, and the neighbouring fields are free of the pest?

On numerous occasions Grevillea and Dadap leaves attacked by an insect were sent into the laboratory for examination. The insect proved to be Tortrix; enquiries and field examinations proved that the tea in the fields from which these leaves were taken *was not attacked by Tortrix.*

The investigator waited until the typical, sudden appearance of tortrix was recorded, and visited the field. Upon climbing and examining a tall grevillea in close proximity to the bushes on which the attack had appeared, it was found that Tortrix was in abundance on the grevillea, and the natural conclusion was the insect had developed and propagated on the grevillea and, possibly through overcrowding or lack of sufficient food, had dropped on to the tea.

Corroboration of this was made in several other instances where the tea being free of tortrix the shade trees (Grevillea, Acacia, Albizzia and Dadap, the latter not so often as the three former) proved to be full of the insect.

LOSS OF CROP.

In one district where 900 acres were attacked in 1914 the loss was calculated at 150,000 lb. of made tea. On one estate of another district where 100 acres were attacked the loss was 60 to 100 lb. per acre. On one yet another where 150 acres were infested 100 to 110 lb. of made tea were lost per acre. These figures have been supplied by planters. Many estates have lost more where the attack has been exceptionally severe, but the average quoted is by no means exaggerated.

Assuming 150 lb. made tea to be the average loss per acre during a severe attack, this represents about 600 lb. of green leaf.

Since August 1917, sixty-three estates have been more or less rigorously attacked. The area infested on each estate averages 50 acres, the total area injured by Tortrix being 3,150 acres. As the attacks were not exceptionally severe we will err on the safe side by reducing the average loss of 600 lb. green leaf to 400 lb. per acre.

Thus on 3,150 acres 1,260,000 lb. of leaf have been destroyed since August last year. In hard cash this represents, at 6 cents per lb., Rs. 75,600 or Rs. 1,200 per estate.

NIGEL K. JARDINE,
Entomologist for Tea Tortrix.

SOILS AND MANURES.

MANUFACTURE OF SUPERPHOSPHATES IN INDIA.

The Committee appointed to consider the value of phosphatic manures by the Board of Agriculture in India and the possibility of arranging for the manufacture of superphosphates on a larger scale in India so as to lessen their cost were asked to report: (a) whether deterioration of soils has been noticed in the various provinces, and, if so whether this is due to phosphate deficiency; (b) whether the needs or the efficacy of manuring with phosphates have been noticed or enquired into; and (c) the possibility of procuring superphosphates in India at a figure which will render their application profitable to the cultivator. The following report of the Committee is reproduced from the proceedings of the Board of Agriculture in India held at Poona in December, 1917 :—

(a) The Committee after considering the evidence available came to the following conclusion:—

The Committee have not sufficient evidence before them to enable them to state definitely that any deterioration of the soil arising from depletion of phosphates has occurred generally throughout India. To decide this point experiments over a number of years would be necessary. Mr. DAVIS' results with Indigo soils in Bihar point to actual deterioration having occurred in this area; but for India as a whole no such evidence at present exists.

(b) Under the second heading evidence showed that enquiries had been made with regard to the effects of phosphatic manuring in different provinces.

In the indigo districts of Bihar such manuring is plainly beneficial.

In Bengal and Assam on the old alluvium there is ample evidence that phosphatic manuring is of value and has given considerable increase with paddy (40 per cent.) mustard and other crops. On the old alluvium lime is also deficient and is probably necessary to enable phosphates to produce their maximum effect.

On the silt alluvium evidence is variable, and no general conclusion can be drawn.

Pending further investigations on the tea garden soils, evidence shows that phosphatic manures are of great value. Basic slag and basic phosphates give the best results. Bone manures and mineral phosphate when applied to the soil have not given noticeable results, except indirectly through green crops.

In the United Provinces in the eastern districts on opium soils it is possible that phosphate manuring may be useful. There is no evidence of phosphate deficiency in other areas.

In the Punjab results appear to indicate that very little benefit is at present found in the use of phosphatic manures in most of the ordinary systems of agriculture adopted in that province.

In Burma soils of the delta show great variations. In some areas the phosphate supply is ample, in others deficient. In general, however, it appears that phosphates will probably prove to be an essential manure in the great rice-growing areas of Burma.

In Madras experiments with phosphatic manuring have been chiefly made with paddy. Marked deficiency in available phosphate is chiefly noticeable in the old paddy soils. All forms of phosphates have yielded marked results. On the laterite high lands chiefly devoted to planting crops, tea, coffee and rubber, paying results have been obtained by the use of basic slag and basic superphosphates.

In Bombay the need for phosphate was most felt in the rice lands of the Konkan, both superphosphate and bone meal repaying the cost of application. Outside this area the scarcity of nitrogen and organic matter appear to be the limiting factor except possibly in the case of leguminous crops notably lucerne.

In the case of cane, phosphate alone has given poor results, but when used as a manure on a preceding green dressing crop the subsequent yield of cane was increased. Early ripening and greater purity of juice were noticed.

In the Central Provinces there appeared to be no indication of the need of phosphate in the black cotton soils. On the light soils of the province it has proved valuable in the case of paddy, sunn hemp and cane. Experiments have not gone far enough to indicate which form of phosphate is preferable.

(c) At present manufacture of superphosphate in India is in so elementary a stage that no definite conclusion can be arrived at regarding the price at which it will be procurable in the future. The retail price of superphosphate before the war was Rs. 50 to Rs. 65 per ton ex-factory or port of entry.

Taking India as a whole, however, there are sufficient supplies of phosphatic manures from all sources to meet the present demands, but there are isolated localities where the question of the supply of superphosphate in the immediate future appears to be important. In these special facilities should be considered to expedite either local manufacture or the import of this commodity.

With a view to encouraging the extended use of phosphatic manures the Committee consider that a survey of the resources of the country in mineral phosphates should be undertaken by Government. In view of the vital importance to Indian agriculture of keeping the supply of phosphates at a price within the reach of the cultivator, the committee suggest that control over all the internal mineral sources of supply should be retained by the Government.

The Committee recommend to the attention of workers the question of investigation of forms of phosphatic manures other than superphosphate as there seems to be distinct evidence in India that the less soluble phosphates particularly in conjunction with bulky organic manures are of great value.

As a result of the above recommendations the two following resolutions were adopted by the Board :—

(1) That with a view to encouraging the extended use of phosphatic manures, the Board consider that a survey of the resources of the country in mineral phosphates should be undertaken by Government. In view of the vital importance to Indian agriculture of keeping the supply of phosphates at a price within the reach of the cultivator, the Board suggest that control over all the internal mineral sources of supply should be retained by Government.

(2) That in view of the great distance over which manures must be carried in India from the centres of supply to the fields of cultivators, the Board is of opinion that the question of reducing internal railway rates charged on such concentrated manures should be considered by the Railway Board.—THE INDIAN TRADE JOURNAL, April 5, 1918.

POULTRY.

THE POULTRY INDUSTRY.

J. C. BEARD,
Poultry Instructor.

HELPFUL HINTS FOR BEGINNERS.

In selecting ground for the keeping of poultry avoid, if possible, heavy clay or black soils. Light sandy soil or loam is far preferable, making less work with better results.

Choose sheltered ground for poultry-keeping, not exposed to the bleak westerly winds, a mistake so often made at the commencement. All shelters should be placed so as to have a north or north-easterly aspect, and the back and two ends should be boarded close with wire in front.

In taking over a sight for poultry-keeping, always see that there is an ample water supply. If outbuildings are already erected, this saves so much capital, as these can be utilised for foodsheds, incubation and storerooms.

Orchard land is always preferable. The fruit adds to one's income, and the trees do better with poultry running beneath them.

Arrange the floor of the house, even if made up inside with soil, higher than the outside ground, to ensure the same keeping dry. Make all perches movable, and these should be all on one level, not, as in the old style, ladder fashion, and avoid using saplings; sawn timbers 3 in. by 1½ in., with top edge a little raised (?). These should be placed on uprights, 2 ft. high, driven into the ground. Cut the head off a 3 in. nail, and drive it in on top of the upright to act as a peg. Bore a small hole through the perch and drop it on to the pegs. These keep the perch in its place, and it is easy to remove the latter when necessary. Keep each end of the perch 1 ft. from the wall.

If fowls will insist on flying out of their pens, cut off short most of the inner flight-feathers on one wing only, leaving the outer flight-feathers intact, otherwise the fowl looks unsightly.

If felt is used on the roofs, this should be tarred once a year, throwing on dust or sand before the tar dries. Creosote is far and away the best preservative for both inside and outside of the houses. No insects can live where this is used, and it acts as a good disinfectant.

Never overcrowd chicken coops, foster-mothers, or fowl-houses, as disease in some form is bound to follow.

When feeding fowls in the morning, care should be taken to give all a portion; those that hang behind and do not readily eat, or remain on the perch, are probably sickening. A careful watch should therefore be kept on them, or disaster may follow.

Rather underfeed birds required for laying and breeding than otherwise. Always remember that overfeeding injures the birds' health, clogs up their

system, and prevents all possibility of their producing eggs, as well as unnecessarily robbing your pocket.

Test all eggs, whether under hens or in incubators, on the sixth day, as this saves time in trying to hatch from useless and infertile eggs.

A male bird can always run with a large number of hens when an unlimited run is provided. But when penning is necessary, for heavy breeds from six to eight and of light breeds eight to ten hens are quite sufficient to breed from with good results, provided there is perch room.

Always place the rearers and chicken-coops in a sheltered position (on short grass), moving the coops every day.

See that chicken-coops and houses are free from draughts and are rainproof, otherwise colds, roup, or other diseases will soon make themselves evident.

Never allow chickens of different ages to run together; the largest are sure to rob the younger ones of their food, and the latter then weaken, droop their wings, and die.

In many cases large clusters of white nits will be found at the root of the feathers around the vent; these should be pulled out, burnt, and carbolic oil applied to the parts.

If a hen or pullet will persist in going into the nest-box, not wanting to lay, nor being broody, it is a sure sign she is ailing.

A fowl moping away from others in a secluded corner should be caught and examined for the cause.

Cleanliness is the keynote to success in the management of poultry.

REPLENISHING THE STOCK.

Few breeders realise the need for renewing the stock from year to year, and they wonder why the chickens do not come out strong and healthy. It is impossible to go on from one year to another without a change of blood, as something injurious is sure to result. The subject of breeding and reproducing species is the most complex question which any breeder has to face; but if it is tackled in the right way there need be no fear, either from loss of quality or stamina.

Nearly every breeder has his own method of getting at results, and many of the old hands get there, while some of the novices fail, and then blame the industry. Now it is usual to use pullets for the earliest breeding pens, not because they are most suitable, but because they come on to lay earlier and produce more eggs than the old birds. But if you want thoroughly reliable chickens, with the strongest stamina, they must be bred from hens in the second season. Many people will not buy these birds, and yet, if they want to breed the best chickens, they must use these, with a vigorous cockerel. To use youngsters on both sides may be one way of getting chickens, but it is better to hatch fifty chickens and rear the lot than to hatch a hundred and only raise fifty.

The best exhibition stock will be reared from hens one year or two years old, even if a cockerel is used; the right thing is to use a male which is full of vigour and fully developed. To breed from immature stock is but to court failure from the start, and have a lot of trouble in the raising. The eggs

from the second-year birds will do better and make larger birds, and will be more suitable for breeding another year. I have known good results from cockerels and pullets when these birds have been bred from old stock, which proves that the vigour is handed down for at least the first generation.

There is often failure in using the same cockerel too long in the same pen, and though he may fertilise the eggs, the germ is not strong enough to hatch out a vigorous chick. The subject of breeding needs more care and thought than is usually given by the novice. What you need are chickens, and it is not enough to get fertile eggs, for if the germ therein is weak, the chick will probably not hatch out ; and even should it do so, it will only live a short time. Now by the keeping of one cock in the pen all the season, this is what happens : He is worked too long and gets weaker as time goes by ; hence the breeding results are far from satisfactory.

If you use one male bird for a month, it will be all the better to give him a rest ; but as this means two cockerels for each pen, the small breeder cannot carry out the idea. But he must do the next best thing. Supposing he has only one cock, and that it is from him that he has to get all his chickens, then the cock must be kept in good form, and this can best be done by generous feeding. I have known of the method of driving the hens into the house and giving the cock an extra feed outside ; but then he should not be kept in the pen too long. To keep setting eggs without raising chickens is so much waste of time and labour, and the object should be to only set the number required and to see that each egg produces a chick.

The ordinary farmer has a very good way of dealing with his stock if he would only keep it up and just breed when the male birds are at their best. As a rule, the hens all run loose round the farm, and roost together ; hence there is no attempt at a breeding-pen, but what chickens are hatched must come from this one lot. When there is a number of hens, he buys, say, three male birds just when he is ready for breeding, and if these have run together there will not be any fighting when they are all put down with the hens, which use the one roost. By this means the whole of the eggs collected are fertilised, and any of them will be good enough to set. Probably his hatching extends over a period of two months, and then it is over. During this time all the eggs should be fertile and the chicks come out healthy and strong. After this time the male birds are killed off, and the next season a fresh lot is got in and the same procedure gone through. As these birds live under the healthiest conditions, with plenty of exercise, both adults and youngsters should do well, and at least 90 per cent. of the eggs be fertile, hatch out and grow into good adult stock.

All breeds are not alike, and some varieties are more active than others ; these, consequently, will take more hens than breeds like the Orpington or Asiatic varieties. Any of the Leghorn family will be more fertile with twelve hens than some Black Orpingtons will be with only three, although, as a rule, Buff and White Orpingtons are more vigorous, and a good cockerel will fertilise all the eggs from eight hens. Wyandottes are fairly active, and the best laying sorts are small birds, which prove fertile up to ten hens, though, if left too long together, the hens should be reduced, or the cockerels should be given a rest. The safest rule for breeding is to use present-year males with two-year hens, and then good results may resonably be expected.

—Queensland Agricultural Journal, April, 1918.

GENERAL.

INDIGO MANUFACTURE IN MADRAS.

CONCLUSION OF REPORT BY DR. F. MARSDEN,

Special Indigo Research Officer.

In the early part of the year the Agricultural Department issued a leaflet (No. 4 of 1917) upon "Possible Improvements in the Manufacture of Indigo in the Madras Presidency," which contains all the advice which we are at present able to give to the ryots. To give fuller details and confirm or disprove the wide variations in statements regarding yield per acre and produce and fix the best conditions of manufacture as applicable to Madras, we should require to control a planted area and at least a couple of vats for some time that we might make proper observations, or we must await the results of the work now being carried out at Pusa and persuade the ryots here to work upon the lines thus found to be the best.

The future of indigo growing for dye will in this Presidency be enormously affected by the market price, and at normal pre-war rates the return is not nearly so great as from some other (especially food) crops; we shall certainly see a great reduction this year in the area planted compared with that of the last two years, owing to the slump which at present rules on account of the absence of freight, and though the introduction of the Java-Natal species would increase the yield per acre, I do not expect that its cultivation will be widely taken up, owing to the necessity of treating the seed with vitriol, or scarifying, to ensure proper germination of the seed, and to the fact that so far it has not been proved that for the climate here it is so suitable as the Sumatrana variety. The latter is hardy and seems to thrive well here under normal conditions and its treatment is understood by the ryot; the only complaint I have had is of the difficulty in ensuring a supply of sound seed and one point which might be taken up with advantage is the regulation of the seed supply from the Nandyal division of the Kurnool district. The seed grown there appears generally to be considered the best throughout Madras, and on this account much old seed and seed of inferior quality has been forwarded there from other districts and distributed from there as pure Nandyal.

Adulteration.—Regarding the low average quality of Madras indigo, this appears to be due

(1) To inability to control the manufacture;

(2) To deliberate adulteration with mud in some two or three districts only.

In Vizagapatam, Kalahasti, Nellore, etc., it appears possible to produce indigo well up to the average quality of Bihar, but there is no doubt that the produce generally varies widely in quality, due to the empirical nature of the observations by which the manufacture can be controlled. This cannot be avoided until we are in a position to lay down definite rules for the ryot for the control of the fermentation in the steeping vat and decide

upon the indications which will show that the steeping is sufficient, and I am hopeful that the investigations at Pusa (when complete) will provide these. At present, however, an indigo prepared with all care by the ryot to the best of his ability may be lower in quality than another which has been deliberately adulterated. Both are marketable and are graded and sold in the first instance entirely on the basis of the appearance and behaviour of the cake. The unscrupulous manufacturer aims at adding just as much foreign matter as will not spoil the appearance of the cake and his attitude appears to be that it pays him, if the market price falls and his dye remains unsold, or only sells at what he considers too low a figure, he is prepared to cease manufacture and put his land under other crops. I am inclined to think, however, that this class of ryot is under a delusion in assuming that adulteration pays him and that the real facts are that in certain districts it is well-known that adulteration is the custom, so merchants protect themselves by basing the prices they offer upon the assumption that adulteration has taken place. European firms have ceased to purchase in some of these districts where adulteration was rife and shipment has been undertaken by small growers who took advances and shipped to London at their own risk; sometimes they made a profit, but more often a loss, and have ceased their activities in this direction. Were the ryots dependent upon the indigo crop, means might be found to persuade them of their mistake, but as it is clear that the cultivation in many cases only attracted them on account of abnormal prices, they will return to their normal crops when prices fall again.—

Report to Government of Madras.

INDIAN TRADE IN OILSEEDS.

The Imperial Institute Bulletin for July-September, 1917, publishes "a comprehensive statement on the Indian oil-seed trade with the two-fold object of calling attention to its great importance and of emphasising the desirability of securing that a far larger proportion of India's output of oilseeds should be utilised in the Empire than has been the case in the past."

The annual exportable surplus of oilseeds in India is well over 5,000,000 tons valued at £50,000,000. In addition India exports about 3¼ million gallons of oil valued at nearly £400,000 and about 200,000 tons of oil-cake worth about £1,000,000.

The principal oilseeds grown in India and exported may be classified according to the character of the oil as follows:—

1 *Solid fats:*—Copra, mhowra.

2 *Non-drying oils:*—Groundnut, castor.

3 *Semi-drying oils:*—Cotton-seed, rape, sesame.

4 *Drying oils:*—Linseed, poppyseed, niger seed.

From the manufacturer's point of view, the oilseeds may be grouped as follows :—

Group 1.—(13 to 36 per cent. of oil or fat). Cotton, linseed, niger, rape.

Group 2.—(42 to 65 per cent. of oil or fat). Poppy, groundnut, sesame, castor, mhowra, copra.

British oilseed crushers have devoted their attention mainly to the crushing of seeds of Group 1. This because the industry began in the days when oilcake for feeding cattle was the chief desideratum and the oil a relatively unimportant material. Later there arose a demand more urgently on the Continent for oils for the manufacture of margarine and other edible fats. The German oilseed crushers gave special attention to copra, palm kernels and other seeds rich in oil. With the advantage of later equipment and plant, and more modern arrangement of factories they monopolised the crushing of rich oil-seeds and even developed the crushing of Egyptian cotton-seed which was virtually a British monopoly to so great an extent that in 1913 they took 44·8% of the cotton-seed Egypt exported. This led British oilseed crushers to turn their attention to Indian cotton-seed which though inferior in many respects have been imported in increasingly large quantities to the United Kingdom.

Of more interest to Ceylon are the statistics and remarks on groundnuts, castor and copra.

GROUNDNUTS.

Of the world's exports of groundnuts in 1913, France took in 68 per cent. Germany appears second with only about 7% of the world's total.

The Indian trade in groundnuts have since recovered from the ravages made by disease on the indigenous variety. This is due to the introduction of disease-resisting varieties, notably, in Madras, the variety obtained from Mozambique which in addition was found to mature within a shorter period, to give a heavier crop and to contain a larger percentage of oil. In recent years an increased demand has arisen for this oilseed through the discovery of processes for refining the oil so that it now competes with olive oil and refined cotton-seed oil as a salad oil and enters largely into the composition of margarine. The season for the export of groundnuts from Madras is between October and March. The bulk of the nuts are shelled before shipment to save freight. The shelled nuts at first could only be used for the manufacture of soap as they arrived at Marseilles in a heated and damaged condition. Recently even this oil can be refined for edible purposes.

It is eminently satisfactory to note that in India there is a large and increasing use for groundnuts. Burma is developing an oil-crushing industry on sound lines. This is thought to be due to the fact that she has had the advantage of the experience gained by a long-established rice-milling industry. The oil is expressed elsewhere in India by primitive methods and is used chiefly for domestic purposes.

The oil-cake has been imported from India to the United Kingdom, Ceylon and Germany. Ceylon has increased her imports from 17,000 tons in 1912-13 to 35,000 tons in 1915-16. These supplies come chiefly from Madras and is largely used as a manure for tea, etc. In Europe groundnut cake is regarded as a very valuable cattle feed and the manure produced by the animals fed on the cake is "exceptionally rich in manurial value."

In India interest is being directed towards the utilisation of such oil-cakes for sugar-cane and for wet lands. It is considered beneficial from the economical point of view as lessening the demands made on cattle manure. The Imperial Institute suggests that the use of oil-cakes suitable for use as feeding cakes as direct manures is not economical where cattle are raised

and cheaper manures are available. In Ceylon the use of groundnut cake as a valuable feed for dairy cattle is hardly realised. It has one defect in this respect that has not been pointed out, i.e., the cake does not keep well tending to go rancid soon.

CASTOR.

India practically has the monopoly of the world's export trade in this seed. A large quantity of oil is made for home consumption and a surplus exported. These exports are gradually dwindling down due to the crude methods adopted for expressing the oil and the wholesale adulteration practised by the small dealers. Besides this the mineral oils are ousting castor oil as a lubricant.

The cake is exported chiefly to Ceylon as a manure for tea, etc. In India it is one of the most valuable of oil-cakes as a manure especially for crops of potato and sugar-cane.

The cake has been used in India as fuel for stationary engines and gas has also been obtained from the cake for lighting railway stations. It is stated, however, as being unable to compete with cheap coal for fuel.

The oil, apart from its use in medicine, is chiefly used as a lubricant on the Indian Railways, it is also used for dressing leather and for the manufacture of Turkey-red oil for alizarine dyeing.

COPRA.

The statistics are of interest in showing the world's annual exportable surplus of copra and the countries that use it.

In 1913, which is considered the latest year for which normal figures are available, the exports were made up as follows :—

	Tons.
British countries	157,527
Allied countries (Philippines=80,904 tons) ...	104,020
Enemy countries	32,377
Neutral countries, i.e., Netherlands East Indies ...	243,500
Total ...	537,424

Ceylon exported in 1913, 55,865 tons, or little over 10 per cent, India's share is about 7 per cent, and that of the whole British Empire nearly 30 per cent., whilst from Netherlands East Indies over 50 per cent. of the world's total is exported. In 1914, Ceylon exported 70,597 tons, and 60,426 tons in 1915.

The chief copra-importing and using countries as shown by the 1913 figures are Germany (195,900 tons) and France (112,328 tons).

During the war the United Kingdom has increased the amount of copra crushed from 14,204 tons in 1913 to 50,311 tons in 1916. Holland has increased her's from 18,279 tons in 1913 to 33,181 tons in 1914, the United States from 15,298 tons in 1912-13 to 49,085 tons in 1915-16. France and Russia are importing and using less. Australia which retained 5,344 tons in 1913, in 1914-15 retained for her use 16,029 tons.

The exports of coconut oil are instructive in showing how India increased her exports, whilst Ceylon remained stationary and even exported less.

	1913	1914	1915
	tons.	tons.	tons.
Ceylon ...	27,349 ...	24,324 ...	25,075
India ...	4,591 ...	4,523 ...	10,508
Philippines ...	4,931 ...	11,754 ...	13,251
Australia ...	1,977 ...	4,231 ...	...

H. L. VAN B.

THE WIDE-SPACING OF CROPS.

R. CECIL WOOD.

Principal, Agricultural College, Coimbatore.

The number of plants in any field may vary much. If too much seed has been sown, there may be many or there may be few. If there are too many plants in the field, they are overcrowded, they cannot get sufficient room, and being short of food and light, they grow stunted and poorly. On the other hand, if the number of plants is insufficient, owing to the seed having been bad, or the rain having fallen after the crop has been sown, there is a great waste of the fertility of the soil, because there are not enough plants to take full advantage of the food and space. The best number of plants. . . depends very largely upon the state of the land and upon the season. In a year of good rainfall and if manure has been applied, more plants can grow well, and bigger yields will be obtained than when the rainfall is poor, or when the land is exhausted. In order to avoid this difficulty, it is a common practice for the ryot to sow his crop rather more thickly than he thinks necessary, and to pull out the plants gradually, as the crop matures, leaving only so many plants as will bear good heads. . . As the ryot is always hoping for good rains, he probably usually oversows his crop, and keeps too many plants in the field. Now, if it is right only to keep a few plants, it is an advantage *that they should be regularly spaced.* This is already done in many parts of the country, and the plants are seen in the field, standing in rows like houses in the streets of a town. If this method of sowing is adopted, you can get a bullock hoe to every plant, just as you can drive a bullock cart to every house in a town, a thing which would be impossible, if the houses were irregularly arranged. . .

In some countries where seeds are very bad and where the soils are difficult to cultivate, each field is left unsown, at regular intervals, for one whole growing season, so that the weeds which grow during that time may be thoroughly eradicated. This implies the loss of a whole crop, and is a great loss, and it is less expensive to grow the crop, in lines wide apart, say 4 feet, and keep the guntaka or other kind of hoe working steadily all the time the crop is growing, till the latest possible time. To one who has not tried this method, it sounds ridiculous to try and grow a full crop at such a distance as this, but experience has shown that very good yields can be had, and the yields of such crops grown on the Central Farm at Coimbatore have been from 900 lb. to 1,000 lb. an acre. The seed is sown behind a country plough with an arrangement for marking the position of the new furrow, so that the lines are parallel and equidistant. The first hoeing is done by hand, but the women only pull out the weeds growing in the lines. Those that grow in the spaces between the lines, are left to be got out by the bullock hoe. The cost of this hand weeding is therefore little, and after that the land can be frequently hoed by bullocks at a cost of about two annas an acre. Each time this is done, the weeds are killed; the land is moreover left in a soft condition, ready to absorb any rain which falls, and by further loosening the surface, this moisture is conserved, and kept in the land, and we thus have more for the crop. The heads produced on crops grown in this way are enormous and the yield of grain is heavy; the straw is necessarily thick and in this respect is probably not so palatable or nutritious as in a more thickly sown crop, but after all, the weeds rob the crop every year, and it is worth while making a special effort to get rid of them, even if we do lose a portion of the crop.

—AGRIC. CALENDAR, MADRAS AGRIC. DEPARTMENT, 1918-1919.

ANIMAL DISEASE RETURN FOR THE MONTH ENDED 31st MAY, 1918.

Province.	Disease.	No. of cases to date since Jan. 1st. 1918.	Fresh cases	Recoveries.	Deaths.	Balance ill.	No. shot.
Western	Rinderpest	46	14	15	29	2	—
	Foot & mouth disease	45	8	41	—	4	—
	Anthrax	2	—	—	2	—	—
	Swine Plague	30	—	—	30	—	—
	Rabies	1	—	—	1	—	—
Colombo Municipality	Foot & mouth disease	87	2	—	—	—	—
	Anthrax	1	—	—	—	—	—
	Rinderpest	9	9	—	—	—	—
	Rabies	6	—	—	—	—	—
Quarantine Station	Anthrax	994	15	—	—	—	—
	Foot & mouth disease	3	3	—	—	—	—
Central	Foot & mouth disease	233	165	197	2	34	—
Northern	—	nil	—	—	—	—	—
North-Western	Rinderpest	8	—	3	5	—	—
	Foot & mouth disease	9	—	9	—	—	—
	Rabies	1	—	—	—	—	1
Eastern	Foot & mouth disease	203	—	183	20	—	—
Sabaragamuwa	Rabies	1	—	—	1	—	—
Uva	Foot & mouth disease	127	69	119	—	8	—
North-Central	Foot & mouth disease	4315	976	4268	47	—	—
Southern	Black-quarter	23	—	—	23	—	—

G. W. STURGESS, G.V.S.

METEOROLOGICAL.

MAY, 1918.

Station.	Temperature: Mean Daily Shade	Temperature: Difference from average	Mean Humidity	Mean amount of cloud 0=clear. 10=Overcast	Mean Wind direction during month	Daily mean Velocity	Rainfall: Amount	Rainfall: No. of Rainy days	Rainfall: Difference from average
	°	°	%			Miles	Inches		Inches
Colombo Observatory	81·3	-0·3	82	7·8	WSW	128	12·14	21	-0·41
Puttalam	82·4	-0·8	78	6·7	SW	236	2·81	14	-0·53
Mannar	85·4	-0·3	70	7·2	SW	183	1·41	7	-0·74
Jaffna	85·2	·0	75	4·4	SW	349	1·22	5	-0·64
Trinco'mee	85·8	-0·4	64	6·6	SW	231	1·25	3	-1·20
Batticaloa	84·8	+0·2	68	5·2	Variable	112	0·62	6	-1·11
Hambantota	81·1	-1·1	84	4·3	SW	327	3·53	18	+0·30
Galle	80·7	-1·2	82	7·3	WNW	236	10·62	24	-0·91
Ratnapura	80·4	-1·5	80	7·3	—	—	18·93	25	+0·93
Anu'pura	82·4	-1·2	74	6·8	—	—	5·53	11	+2·05
Kurunegala	81·0	-2·0	74	8·1	—	—	11·65	21	+5·45
Kandy	75·6	-3·1	72	7·9	—	—	10·97	18	+5·49
Badulla	75·4	-0·4	74	6·7	—	—	1·80	15	-2·79
Diyatalawa	70·0	-0·7	64	7·4	—	—	1·89	14	-3·19
Hakgala	62·5	-1·2	79	7·8	—	—	9·43	21	+2·60
N'Eliya	61·4	-0·3	86	8·7	—	—	11·21	21	+4·53

Rainfall for the month was in slight deficit in the South and East, and in excess in the North-west and centre of the island.

The mean temperature was in deficit almost throughout.

The force of the wind and cloud amount were almost everywhere above the normal.

J. E. EVANS,
Acting Supdt., Observatory.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Latest Monthly Prices Current.)

	QUALITY.	Quotations.
ALOES, Soccotrine cwt.	Fair to fine	110/ a 120/
Zanzibar & Hepatic ,,	Common to good	40/ a 105/
ARROWROOT (Natal) lb.	Fair to fine	1½d a 1/
BEES' WAX cwt.		
Zanzibar Yellow ,,	Slightly drossy to good	£9 a £9 5/ nom.
East Indian bleached ,,	Fair to good	£11 12/6 a £12 ,,
,, unbleached ,,	Dark to good genuine	£8 10/a £8 15/ ,,
Madagascar ,,	Dark to good palish	£9 a £9 7/6 ,,
CAMPHOR, Japan lb.	Refined	4/3 a 4/9
China cwt.	Fair average quality	Nominal
CARDAMOMS, Tuticorin	Good to fine bold	3/6 a 4/6 nom.
per lb.	Middling lean	2/ a 2/9 ,,
Malabar, Tellicherry ,,	Good to fine bold	3/ a 4/ ,,
Calicut ,,	Brownish	1/9 a 2/6 ,,
Mangalore ,,	Med Brown to good bold	2/6 a 3/3 ,,
Ceylon, Mysore ,,	Small fair to fine plump	2/ a 5/
Malabar ,,	Fair to good	1/7 a 1/8
Seeds, E. I. & Ceylon ,,	Fair to good	2/6 a 3/
Ceylon "Long Wild" ,,	Shelly to good	1/ a 1/6 nom
CHILLIES, Zanzibar cwt.	Dull to fine bright	75/ a 85/
Japan ,,	Fair bright small	80/ a 85/
CINCHONA BARK.—lb.	Crown, Renewed	3½d a 7d
Ceylon	Org. Stem	2d a 6d
	Red Org. Stem	1½d a 4½d
	Renewed	3d a 5½d
	Root	1½d a 4d
CINNAMON, Ceylon 1sts.	Fair	2/6
per lb. 2nds.	,, ,,	2/3
3rds.	,, ,,	2/
4ths.	,, ,,	11d
Chips,	Fair to fine bold	1/6 a 1/8
CLOVES, Penang lb.	Dull to fine bright pkd.	3/6 a 4/
Amboyna ,,	Dull to fine	2/ a 2/6
Zanzibar ,,	Fair and fine bright	2/2 a 2/4
Madagascar ,,	Fair	2/ a 2/1
Stems ,,	Fair	7½d
COFFEE		
Ceylon Plantation cwt.	Medium to bold	Nominal
Liberian ,,	Fair to bold	,,
COCOA, Ceylon Plant. ,,	Special Marks	93/ a 95/
	Red to good	87/ a 92/
Native Estate	Ordinary to red	50/ a 86/
Java ,,	Small to good red	70/ a 100/
COLOMBO ROOT ,,	Middling to good	170/ a 190/
CROTON SEEDS, sifted ,,	Dull to fair	55/ a 60/
CUBEBS ,,	Ord. stalky to good	£16/ a £17/ 10/
FIBRE, Kitul lb.	OOO good long	10d a 11d [nom.
	OO ,, medium	8½d
	No. 1 fair	7d
Palmyrah ton.	Common to fair	£50/ a £60 nom.
,,	Medium to good med	£60/ a £80 ,,
	Good to fine	£90/ a £115 ,,
GINGER, Bengal, rough cwt.	Fair	82/6
Calicut, Cut A ,,	Medium to fine bold	110/ a 120/
B & C ,,	Small and medium	100/ a 110/
Cochin, Rough ,,	Common to fine bold	85/ a 90/
	Small and D's	85/
Japan ,,	Unsplit	75/
GUM Ammoniacum ,,	Ord. blocky to fair clean	175/ a 200/
Animi, Zanzibar	Pale and amber, str. srts	£14 10/a £16 10/
,,	,, ,, little red	£11 a £12
,,	Bean and Pea size ditto	£5 a £11
,,	Fair to good red sorts	£8 10/ a £10 10/
,,	Med. and bold glassy sorts	£7 a £8 10/
Madagascar ,,	Fair to good palish	£4 a £8
,, ,,	red	£4 a £7
Arabic, E. I. & Aden ,,	Ordinary to good pale	55/ a 75/
Turkey sorts ,,	... ...	85/ a 87/6
Ghatti ,,	Sorts to fine pale	30/ a 50/
Kurrachee ,,	Reddish to good pale	35/ a 50 nom.
Madras ,,	Dark to fine pale	30/ a 45 nom.
Assafœtida ,,	Clean fr to gd. almonds	£15 a £20
	com. stony to good block	£4 a £10
INDIGO, E.I. Bengal lb.	Shipping mid to gd. violet	10/ a 12/
,,	Consuming mid. to gd.	9/ a 96
,,	Ordinary to middling	7/6 a 9/
,,	Mid. to fine Kurpah	6/6 a 9/
,,	Low to ordinary	4/6 a 6/7
,,	Mid. to fine Madras	2/6 a 4/6
KAPOK lb.	Ordinary to good	1/ a 1/4
KINO lb.	Fair to fine bright	6d a 1/5
MACE, Bombay & Penang		
per lb	Pale reddish to fine	3/6 a 4/
	Ordinary to fair	3/ a 3/6
Java	,, ,, good pale	3/3 a 4/
Bombay	Wild	8d
MYRRH, Aden sorts cwt.	Middling to good	190/ a 210/
Somali ,,	,, ,,	160/ a 180/

	QUALITY.	Quotations.
NUTMEGS,— lb.		
Singapore & Penang ,,	64's to 57's	3/ a 3/3
	80's	2/9
	110's	2/4
NUX VOMICA, Cochin	Ordinary to good	42/6 a 45/
per cwt. Bengal	,, ,,	40/ a 42/
Madras	,, ,,	40/ a 43/
OIL OF ANISEED		4/3
(China) lb.	Fair merchantable	
CASSIA ,,	According to analysis	6/3 a 6/9
LEMONGRASS		
(Cochin) oz.	Good flavour & colour	6d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON (Ceylon) oz.	Ordinary to fair sweet	1/ a 2s 9d
CITRONELLE ,, lb.	Bright & good flavour	3/
OLIBANUM, drop cwt	Good to fine white	130/ a 150/
,,	Middling to fair	100/ a 120
pickings ,,	Low to good pale	22/6 a 40/
siftings ,,	Slightly foul to fine	35/ a 45
ORCHELLA WEED—cwt		
Ceylon ,,	Fair	10/6
Madagascar ,,	Fair	10/6
Zanzibar ,,	Fair	10/6
PEPPER—(Black) lb.		
Alleppy & Tellicherry	Fair	1/3½ a 1/4½
Ceylon ,,	Fair to fine bold heavy	1/4 a 1/4½
Singapore ...	Fair	1/4
Acheen & W. C. Penang	Dull to fine	1/4
(White) Singapore ,,	Fair to fine	2/ a 2/1
Siam ,,	Fair	2/
Penang ,,	Fair	1/10
Muntok ,,	Fair	1/8½
RHUBARB, Shenzi ,,	Ordinary to good	1/8 a 3
Canton ,,	Ordinary to good	1/6 a 2/6
High Dried ,,	Fair to fine flat	2/ a 2/3
RUBBER, INDIA lb.	Standard smoked sheets	2/4½
Ceylon, Straits, ,,	Standard Crepe	2/5
Malay Straits, etc. ,,	Scrap fair to fine	1/8 a 1/0
Assam ,,	Fair 11 to ord. red No. 1	1/4
Rangoon ,,	,, ,, ,,	1/6
Borneo ,,	Common to good	1/6
Java ,,	Good to fine red	1/8 a 1/10
Penang ,,	Low white to prime red	1/6 a 1/9
Mozambique ,,	Sausage, fair to good	1/6 a 2/
Nyassaland ,,	Fair to fine ball	1/6 a 2/
Madagascar ,,	Fr. to fine pinky & white	1/4 a 1/7
,,	Majunga & blk coated	1/
,,	Niggers, low to good	9d a 1/6
New Guinea ,,	Ordinary to fine ball	1/6 a 2/
SAGO, PEARL, large—cwt	Fair to fine	70/ a 75/
medium ...	,, ,,	70/ a 75/
small ...	,, ,,	75/ a 77/6
Flour ...	Good pinky to white	75 a 77/6
SEEDLAC cwt.	Ordinary to gd. soluble	105/ a 110. nom.
SENNA, Tinnevelly lb.	Good to fine bold green	9d a 10d
	Fair greenish	5½d a 8d
	Common specky & small	3½d a 4½d
SHELLS, M. of PEARL—		
Egyptian cwt.	Small to bold	40 a £5 10 nom
Bombay ,,	,, ,,	55 a £5 15 ,,
Mergui ,,	Chicken to bold	£7 a £14 10/ ,,
Manilla ,,	,, ,,	£7 a £11 10/ ,,
Banda ,,	Sorts	40. a 45/ ,,
Green Snail ,,	Small to large	60/ a 90. ,,
TAMARINDS, Calcutta...	Mid to fine bl'k not stony	45/ a 50/
per cwt. Madras	Inferior to good	25/ a 35/
TORTOISE SHELL —		
Zanzibar & Bombay lb.	Small to bold	10/ a 26/
	Pickings	7/ a 15/
Ceylon	Small to bold	10. a 24.
Mauritius & Seychelles	,, ,,	10/ a 28/
TURMERIC, Bengal cwt.	Fair	50/
Madras ,,	Finger fair to fine bold	67/6 a 70/
Do. ,,	Bulbs ,, ,, [bright	45/ nom.
Cochin ,,	Finger fair	50/ nom.
	Bulbs ,,	37/6
VANILLOES.— lb.		
Mauritius ... } 1sts.	Gd. crystallized 3½a 8½ in.	5/6 a 9.6
Madagascar ... } 2nds.	Foxy & reddish 3½a ,,	5/ a 7/
Seychelles ... } 3rds	Lean and inferior	5/ a 5/9
WAX, Japan, squares, cwt.	Good white hard	115/

Registered as a
Newspaper in Ceylon.

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IMP. ENTO.
21 MAR. 1918
ENTOM.

VOL. L. No. 1.

The Tropical Agriculturist

(Founded in 1881 by the late MR. JOHN FERGUSON, C.M.G., F.R.A.S., F.R.C.I.)

Journal of the
CEYLON AGRICULTURAL SOCIETY

JANUARY, 1918.

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VOL. L. No. 2.

The Tropical Agriculturist

(Founded in 1881 by the late MR. JOHN FERGUSON, C.M.G., F.R.A.S., F.R.C.I.)

Journal of the
CEYLON AGRICULTURAL SOCIETY

FEBRUARY, 1918.

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ENTOM.

VOL. L. No. 3.

The Tropical Agriculturist

(Founded in 1881 by the late MR. JOHN FERGUSON, C.M.G., F.R.A.S., F.R.C.I.)

Journal of the
CEYLON AGRICULTURAL SOCIETY

MARCH, 1918.

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21 JUN. 1918
ENTOM.

VOL. L. No. 4.

The Tropical Agriculturist

(Founded in 1881 by the late MR. JOHN FERGUSON, C.M.G., F.R.A.S., F.R.C.I.)

Journal of the
CEYLON AGRICULTURAL SOCIETY

APRIL, 1918.

Peradeniya, Ceylon.

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Registered as a
Newspaper in Ceylon.

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Rec'd 12 AUG 1918
Lond.

VOL. L. No. 5.

The Tropical Agriculturist

(Founded in 1881 by the late MR. JOHN FERGUSON, C.M.G., F.R.A.S., F.R.C.I.)

Journal of the
CEYLON AGRICULTURAL SOCIETY

MAY, 1918.

Peradeniya, Ceylon.

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IMP. BUR.
6 - AUG. 1918
ENTOM.

VOL. L. No. 6.

The Tropical Agriculturist

(Founded in 1881 by the late MR. JOHN FERGUSON, C.M.G., F.R.A.S., F.R.C.I.)

Journal of the
CEYLON AGRICULTURAL SOCIETY

JUNE, 1918.

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